Liber Jagiel. 1827

AN
EASY INTRODUCTION
TO THE
ARTS AND SCIENCES:

BEING A SHORT, BUT COMPREHENSIVE
SYSTEM
OF
USEFUL AND POLITE LEARNING.
DIVIDED INTO LESSONS.

ILLUSTATED WITH CUTS,
AND ADAPTED TO THE USE OF SCHOOLS AND ACADEMIES.

BY R. TURNER, JUN. LL.D
Late of Magdalen Hall, Oxford;
AUTHOR OF AN EASY INTRODUCTION TO GEOGRAPHY, &c.

Ingenuas didicisse fideliter artes
Emollit mores.———
Asperitatis et invidiæ corrector et iræ.

To have learned the liberal arts thoroughly, softens the manners, and operates as an excellent corrector of ill-nature, envy, and anger.

OVID. HOR.

THE SEVENTEENTH EDITION,
With considerable Additions and Improvements; particularly
AN ABRIDGEMENT OF NATURAL HISTORY,
With upwards of Twenty New Cuts;
Sequel of Physics, or Natural Philosophy; the present State of Electricity, Galvanism, &c. &c.

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1816.

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TO THE

PRESENT EDITION.

AFTER acknowledging, with gratitude, the favourable reception and rapid ſale of the laſt Edition of this little Work, it remains only to ſtate, that the neceſſary alterations which the changes in the French Government have cauſed, are noticed in their proper places, as will be ſeen by a reference to Leſſons 14 and 15.

October 1816.

PREFACE.

It was ſaid of one of the ancients—I think it was SOCRATES, or his diſciple PLATO—that he brought Philoſophy down from heaven to dwell among men upon earth,

THE ſame may, in ſome meaſure, be affirmed of all thoſe who ſucceſsfully endeavour to render the ARTS and SCIENCES, which were formerly wrapped up in the learned languages, and in technical terms, intelligible to the bulk of mankind, or to thoſe who have not had the advantage of a liberal education.

SUCH was, no doubt, the deſign of Dr. TURNER, in the preſent publication; and

if he did not render it more copious and comprehenſive, it was neither for want of inclination nor ability, but merely from a deſire of confining the ſize of the book, as well as its price, within as narrow limits as poſſible.

He intended, however, had he lived, to have made many additions to the work. Theſe he purpoſed chiefly to introduce in the article of Phyſics or Natural Philoſophy, convinced that what he had already ſaid on Metaphyſics and Moral Philoſophy was as much as was neceſſary or proper for thoſe for whoſe uſe the book was expreſsly compoſed.

The Editor of the fourth Edition had an opportunity of being perfectly acquainted with the Doctor's ſentiments in theſe particulars, and endeavoured to execute his intentions in the beſt manner he could.

The Additions, that were therein made to the work, were interſperſed through various parts of it; but will chiefly be met with in the Appendix at the end, where

the reader will fee three articles, containing abridgments of Natural Hiftory, and the fciences of Electricity and Galvanifm, which were totally unknown to the ancients, and which, though they had fo long efcaped the refearches of mankind, are yet fuppofed to be the real fources of many of thofe phenomena or appearances which were formerly afcribed to fupernatural caufes.

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TO THE

FIFTEENTH EDITION.

THE liberal patronage of a generous Public, which had rewarded the Proprietors' exertions by the rapid ſale of thirteen large impreſſions, called forth their gratitude in cauſing the laſt and preſent edition to be reviſed and improved. The article on GALVANISM, a ſcience which has developed many phenomena before little underſtood, has been entirely added, and many other articles have been much improved, as a ſlight compariſon will demonſtrate.—No care or expence has, in ſhort, been wanting to render it ſtill more deſerving of that general approbation, with which it has been ſanctioned through the former editions, by the corrections, additions, and advantages of the preſent.

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AN

ABRIDGMENT

OF THE

ARTS AND SCIENCES.

LESSON I.

OF RELIGION.

" The fear of the Lord is the beginning of wiſdom ;
" a good underſtanding have all they that keep his
" commandments." DAVID.

" Be particular not to neglect religion in the education
" of your children. In vain will you endeavour to
" conduct them by any other path. If *they are dear*
" *to you*, if you *expect from them credit and comfort*,
" from religion muſt be derived their happineſs and
" your own." FATHER GERDIL.

RELIGION! ſoother of all our keeneſt ſorrows, ſource and refiner of all our real joys! ſhed thy heavenly influence on our ſouls; direct, animate, and crown our purſuits; pervade and conſecrate all our thoughts, words, and actions; or we can never anſwer the deſign of God in our creation; but ſhall

fall ſhort of true happineſs in this life, and ſink to the compleateſt wretchedneſs in that which is to come.

Queſt. What is religion?

Anſ. It is that general habit of reverence towards the Divine Being, by which we are enabled and inclined to worſhip and ſerve God in ſuch a manner as we conceive moſt agreeable to his will, ſo as to procure his favour and bleſſing.

Q. What is the ſource and foundation of religion?

A. The foundation of all religion reſts on the belief of the exiſtence of a ſuperior being, who governs the world, and upon whom the happineſs or miſery of mankind ultimately depends. Religion is uſually conſidered under two heads, viz. Natural and Revealed.

Q. What is natural religion?

A. It is founded on thoſe notions of a Divine Being which may be attained by the light of nature and reaſon.*

* Man has been defined a rational creature, but ſome of the brute creation, as the horſe, dog, elephant, &c. diſcover ſuch traits of reaſon, as ſhew it to be by no means excluſively confined to man. He has therefore been called a *religious* animal, ſince no creature, except man, appears to have any ſenſe of religion.

Q. What is meant by revealed religion?

A. It depends on the discoveries made by the supreme being to his prophets, and more particularly to his son Jesus Christ, the greatest of all prophets; and by them to the world, by means of the books of the old and new Testament. Revealed religion is either the Jewish or Christian.

Q. On what is the Jewish religion founded?

A. On the law given by Moses to the tribes of Israel, and the various prophecies of the Old Testament.

Q. Who is the author of the Christian religion?

A. Jesus Christ, who in the scriptures of the New Testament is emphatically styled the Son of God, or Messiah, and the Saviour of men.

Q. Was he a person of high rank?

A. No: in the estimation of the world his descent was very mean. In his youth he was a pattern of obedience to all children: when he attained more advanced years, he probably followed the business of a carpenter; and after his baptism by John, he travelled on foot, preaching the glad tidings of the gospel to his countrymen. During the whole of his mission he was contented with mean lodgings, and humble fare; and chose for his com-

panions, whom he made apoſtles or preachers, virtuous but obſcure characters; and at laſt he was crucified as a martyr, and was raiſed to life by the Almighty, thereby proving the divinity of the religion which he had taught.

Q. Are there any falſe religions?

A. Yes, many; but the two principal are Paganiſm and Mahometaniſm.

Q. What is Paganiſm?

A. The religion of heathen nations. As the Deity, in this, is repreſented under various forms, and by all kinds of images or idols, it is called idolaty, or image worſhip.

Q. From whom had Mahometaniſm its riſe?

A. From Mahomet, who was born at Mecca, a city of Arabia, in 571, and died at Medina in the year 631. His ſyſtem is a compound of Paganiſm, Judaiſm, and Chriſtianity, contained in the Koran, or Alcoran.

Q. What do you mean by pure religion?

A. That which is founded on the word of God only: whereas corrupted religion is that which is full of human conceits and devices.

Q. Of what advantage is an exact obſervance of religion to a ſtate?

A. Very great; it inſpires honeſty in every one, juſtice in princes, fidelity in ſubjects, integrity in magiſtrates, good faith in commerce, union and fidelity in marriage.

LESSON II.

OF THE ARTS AND SCIENCES.

" The *taking a taste of every sort* of knowledge is ne-
" cessary to form the mind, and is the only way to
" give the understanding its due improvement to the
" full extent of its capacity." LOCKE.

Quest. WHAT is science?

Ans. A certain knowledge of something, deduced from self-evident principles.

Q. What is art?

A. Art is the way of doing a thing surely, readily, and gracefully, which is not taught by nature and instinct.

Q. How are the arts divided?

A. Into liberal and mechanical: the *liberal* arts are philosophy, rhetoric, grammar, mathematics, astronomy, painting, music, and sculpture.

Q. Why are they so called?

A. Because the ancients allowed them to be studied only by the *Liberi* or free persons.

Q. How many sciences are there?

A. Eight principal ones: 1ſt, Theology; 2d, Philoſophy; 3d, Juriſprudence; 4th, Medicine; 5th, Rhetoric; 6th, Grammar; 7th, Poetry; and 8th, the Mathematics.

I. *Of Theology.*

Q. What is theology?

A. That ſcience which contemplates the nature of God and divine beings: the term is derived from two Greek words, viz. Θεος, *God*, and λογος, *word*, or diſcourſe, that is, the *word of God*, or a diſcourſe concerning God.

Q. How may the exiſtence of God be proved?

A. What is neceſſary to be known of God is manifeſt in the works of the creation. The heavens declare the glory of God. The ſun, the moon, the ſtars, ſhew themſelves to be his handy-work. There is no nation where his voice is not heard, for it is gone through all the earth, and his word to the end of the world.

Q. To whom was the title of *theologian* firſt given?

A. To St. John, who has by that name been diſtinguiſhed from the other three evan-

gelifts, becaufe they only wrote the hiftory of the life of Jefus Chrift; but the writings of St. John enter more at large into the nature and attributes of the divine being.

II. *Philofophy.*

Q. What is philofophy?

A. The ftudy of nature and morality; the word is often ufed to denote the fciences, of which the univerfe is the object: the etymology of the term philofophy is derived from two Greek words, φιλος and Σοφος, fignifying *love* and *wifdom*, or *knowledge*: and the term originally meant the love of wifdom or knowledge.

Q. What are the principal objects of philofophy?

A. God: the works of Nature and Man. It is divided into logic, morality, phyfics, and metaphyfics.

1. *Logic.*

Q. What is logic?

A. The art of thinking and reafoning juftly in our enquiries after truth, and the communications of it to others. The profeffed bufinefs of logic is to explain the nature of

the human mind, and the proper manner of conducting its several powers, in order to the attainment of truth and knowledge.

Q. In what does this art consist?

A. In the reflections made by men upon the four principal faculties of their mind, perception, judgment, reasoning, disposition.

Q. What is gained by this science?

A. It lays open those errors and mistakes that we are apt through inattention to fall into: and it teaches us how to distinguish between truth, and what only carries the appearance of it: it shews also in what certainty and demonstration are to be attained, and when we must be contented with probability.

2. *Morality.*

Q. In what are we instructed by morality?

A. It gives us rules for our behaviour, manners, and conduct, whether in public or private life, and is properly called *Ethics*, from the Greek word ἦθος, and *morality*, from the Latin word *mos*, plural *mores*, both signifying manners or behaviour. In other words, this science may be described as teaching the knowledge of our duty, or the art of being virtuous and happy.

Q. Into what does morality or moral philosophy enquire?

A. It enquires how man is constituted; and in what the principles and dispositions of his actions and habits may be resolved.

Q. What is the result of the enquiries into this subject?

A. That the well being of man, as it respects his health and peace of mind, must consist in the supremacy of reason and conscience, and in the subordination of the passions and affections to their authority and direction.

3. *Physics.*

Q. From what is the word physics derived?

A. From the Greek word φυσις, *nature*, or υσικη, *natural*.

Q. Of what do physics treat?

A. Of natural philosophy in general, and of the doctrine of natural bodies, their phenomena, causes, and effects, with their various affections, motions, operations, &c.

4. *Of Meteors.*

Q. What is a meteor?

A. A meteor is a changeable, moveable,

and imperfect body, or resemblance of a body, appearing in the air or atmosphere, and exhibiting various appearances. Meteors may be reduced to three classes, fire-balls, shooting-stars, and ignes fatui.

Q. Can you give an account of any remarkable meteors?

A. There were in the years 1783 and 1785 two very striking meteors: the one in 1783 was supposed to be at least 1000 yards in diameter: that in 1785 passed with such great rapidity that it did not allow people to recover from their astonishment and terror before it had vanished: the light was very similar to a flash of lightning; and its velocity produced a noise like that of distant thunder.

Q. What is meteorology?

A. It is the science of studying the phenomena of the air or atmosphere.

Q. What is the air?

A. A transparent and invisible fluid, encompassing all parts of the terrestrial globe. The air near the earth has been found to be 800 times lighter than water: in the higher regions it is still lighter.

The weight of a column of air, reaching from the surface of the earth to the top of the atmosphere, is equal to that of a column of water, of the same diameter, about 33 feet

high; for ſo high, and no higher, will water riſe in a pump, by the preſſure of the external air, after the air within the pump has been extracted by the piſton. Now the weight of a ſquare column of water, 1 foot thick and 33 feet high, is 2160 pounds; ſo that a man of a middling ſize, the ſurface of whoſe body is about 14 ſquare feet, ſuſtains a preſſure of air of 30,240 pounds, when the air is of a moderate gravity: a preſſure that would be inſupportable, and even fatal to him, were it not that it is equal on every part, and counterbalanced by the ſpring of the air within him, which is diffuſed through the whole body, and re-acts againſt this preſſure with an equal preſſure. Hence it is, that a column of mercury, in the barometer, from the ſame principle, does not riſe higher, on a medium, than 29 inches and a half, which is about the fourteenth part of 33 feet, and the ſpecific gravity of mercury is to that of water nearly as 14 to 1.

Q. What is the compoſition of meteors?

A. Some are found to be ſtony bodies that have been analyſed by chemiſts, ſuch are the meteoric balls; but the ſhooting ſtars and ignes fatui are probably electrical phenomena, occaſioned by the inflammation of different ſpecies of hydrogen gas.

Q. Have ſtones actually fallen from the air

A. The fact is certain; it has been obſerved in many parts of the world; and th only difficulty is to aſcertain whence the come; whether from the moon; or whethe they are formed by chemical combination i the atmoſphere.

LESSON III.

5. *The Winds.*

Q. WHAT is the wind?

A. Nothing elſe but the air put into motion; and this occaſioned chiefly by means of heat. For, when any part of the air is heated by the ſun, or otherwiſe, it will be expanded, and become lighter; but the lighter body always aſcends, and leaves a partial vacuum, to which the ſurrounding air will be impelled; and ſo, by various degrees of heat in different places, there will ariſe various motions of the air.

When the air is much heated, it will aſcend towards the upper part of the atmoſphere, and the adjacent air will ruſh in to ſupply its place; and therefore there will be a ſtream or current of air, from all parts, towards the place where the heat is. And hence we ſee the reaſon why the air ruſhes with ſuch force into a glaſs-houſe, a tile-kiln, or towards any place where a great fire is made: and alſo why ſmoke is carried up a chimney, and why the air ruſhes through the key-hole of the door,

or any ſmall chink, when there is a fire in the room. So in gerenal we may take it for granted, that the air will preſs towards that part of the world where it is moſt heated.

Q. How are the winds divided?

A. Into four principal ones, the NORTH, SOUTH, EAST, and WEST, which receive their names from the four principal quarters of the world.

Q. What are the diſtinguiſhing properties of the ſeveral winds?

A. The frigid zone is the parent of the north wind, which is conſequently the coldeſt.

The ſouth weſt is the warmeſt, particularly in the ſummer, becauſe it comes from the torrid zone, over countries hotter than ours.

With the ſouth eaſt wind we generally have rain.

The eaſt wind is the drieſt, becauſe it comes acroſs the vaſt continent of Aſia, but little watered by rivers or ſeas.

The weſt wind is generally damp, and often blows us rain; becauſe, as it croſſes the great Atlantic Ocean, it attracts a great quantity of vapours.

Q. What effect is produced by the ruſhing together of theſe winds?

A. When theſe impetuous winds happen to meet, the greateſt inconveniencies follow.

From hence proceed tempefts, thunder, rain, hail, and whirlwinds.

Q. What is the velocity of thewind?

A. The velocity of the wind is at the rate of 50 or 60 miles an hour in a great ftorm; that of a common brifk wind is about 15 miles an hour; and fome winds move not even one mile in that fpace of time.

A perfon, therefore, on horfeback, and even fometimes on foot, may be faid to outftrip the wind; for if he moves fafter than the wind, which is very poffible, he will have a wind in his face, though the motion of the air be really the contrary way.

Q. Does the air ever move in different directions at the fame time?

A. The air is often feen to move in two contrary currents, and this almoft always happens previoufly to thunder. The clouds in fuch a cafe are feen to move one way, while the weather-cock points another.

Red clouds appearing in the morning prefage winds and rain,

6. *Clouds and Mifts.*

Q. How are mifts formed?

A. Mifts are thofe collections of vapours which chiefly rife from fenny and moift

places, and become more viſible as the light of the day decreaſes.

Q. What are clouds?

A. Clouds are a collection of miſty vapours, ſuſpended in the air, ſoaring on the wings of the wind in a ſtate ſo condenſed as to appear dark.

Q. Pray how high do you ſuppoſe the clouds to fly?

A. From about a quarter of a mile to a mile. It is common for perſons, by climbing very high mountains, to get above the clouds, and ſee them ſwim beneath them, and, as it were, bruſhing the ſide of the mountains on which they ſtand.

Q. Whence come the various figures and colours of the clouds?

A. The wonderful variety in the colours of the clouds is owing to their particular ſituation with regard to the ſun, and the different reflections of his light; the various figures of the clouds reſult from their texture, revolving into any form according to the different force of the winds.

7. *Rain.*

Q. What is rain?

A. Rain proceeds from thick clouds co-

denſed by the cold, and which, by their own weight, fall upon the earth in drops.

Q. What are the ſigns that foretel rain ?

A. Small clouds ſeen very high, heaped one upon the other, preſage rain very ſoon.

When the horizon, at the riſing or ſetting of the ſun, appears pale and yellowiſh, it is a ſign of the air being full of vapours, and threatens bad weather.

But when it is of a light red at thoſe times, there are but few vapours in the air, and fine weather may be expected.

If the cloud that melts is greatly rarefied, and its particles, in falling, meet an air moderately warm, theſe drops will be ſo ſmall, that they will not compoſe rain, but rime only.

Q. In what countries is there moſt rain ?

A. Hilly and mountainous diſtricts are moſt ſubject to rain, ſo alſo are iſlands and countries near the ſea. Among the Andes it rains inceſſantly, but the flat country of Egypt is conſumed by perpetual drought.

8. *The Dew.*

Q. From what is the dew produced ?

A. From a quantity of particles of water that float about in a calm and ſerene air in the form of vapours ; theſe, being condenſed

by the coolneſs of the night, loſe by degrees their motion; and many uniting together, fall in the evening in ſmall inviſible particles, like an extremely fine and delicate rain, which continues but a ſhort time, and is ſeen in drops of water, like pearls, upon leaves and herbs.

9. *Of Snow.*

Q. How is ſnow formed?

A. Snow is produced in winter in the cold regions of the air, where the clouds paſs from that ſtate of condenſation which might reduce them to rain into that which is able to reduce them to ice; ſo that as ſoon as the clouds begin to change into very fine drops of water, each of theſe ſmall particles freeze, and, touching each other, form flakes of ſnow.

Q. Why are theſe flakes ſo light and the ſnow ſo white?

A. The ſmall intervals that the flakes leave between them, like ſo many pores, filled with air, are the cauſe of their lightneſs.

The ſnow is white, becauſe the ſmall particles of ice that compoſe thoſe flakes being hard, ſolid, tranſparent, and differently arranged, reflect the light from all parts.

LESSON IV.

10. *Of the Hail.*

HAIL is formed when the parts of the cloud, beginning to fall, meet in their defcent a very cold air, which freezes them, and forms fmall bits of ice, which are very near the figure and fize the drops of water would have been had they fallen.

11. *Thunder and Lightning.*

Q. What is thunder?

A. A noife heard in the air, moft frequently in the fummer, which is excited by a fudden explofion or rufhing together of electrical clouds, called thunder clouds.

Q. Can the clouds be known before the ftorm?

A. The firft appearance of a thunder ftorm is one denfe cloud, or more, increafing very faft in fize, and rifing into the higher regions of the air. The lower furface is black and nearly level; but the upper is finely arched and well defined. Many of thefe clouds often feem piled one upon another.

Q. Why is the lightning ſeen before the thunder is heard?

A. Becauſe ſound is longer in arriving to our ears than light to our ſight. Light moves almoſt inſtantaneouſly: ſound moves no more than 1142 feet in a ſecond. That light moves much faſter than ſound, any one may ſatisfy himſelf by obſerving a gun diſcharged at a diſtance, for he will ſee the fire long before he hears the ſound. Hence a method is found of calculating the diſtance of a thunder-ſtorm or of a ſhip in diſtreſs.

Example 1. If there be 15 ſeconds of time elapſe between the flaſh of lightning and the thunder, you are diſtant fifteen times 1142 feet from the ſpot of danger, or 5710 yards, or more than three miles.

2. If you obſerve the light of a ſignal gun, from a ſhip in diſtreſs, 9 ſeconds before you hear the report, you know the ſhip is 9 times 1142 feet, or 3426 yards, or nearly two miles off. To thoſe who have no ſtop watch, and whoſe pulſe is regular, that is, which beats about 75 in a minute, a mile may be allowed for every ſix pulſations; of courſe, if the difference between the ſight and report of thunder or a gun be 9 ſeconds, the diſtance is one mile and a half.

Q. What caufes the continuation of the noife of thunder?

A. The continuation and repetition of the found is caufed by a kind of echo, which returns thofe rollings we hear after a great clap of thunder.

Q. I have heard of thunder-bolts and their ftrange effects, pray what are they?

A. If what we call lightning acts with extraordinary violence, and breaks and fhatters whatever oppofes its progrefs, it is called a thunder-bolt; which the vulgar fuppofe to be a hard body, and even a ftone.

Q. Is it the lightning that does the mifchief, and not the thunder?

A. Since the great difcoveries in electricity, almoft every effect afcribed to thunder-bolts may be imitated by the electrical machine and apparatus, by which it is demonftrated that thunder is but a mere found, and that lightning is the powerful and deftructive agent. It flies with incredible fwiftnefs from the clouds to the earth, and through every thing ftanding in its way. It fometimes kills men and animals, burns and overthrows large trees and buildings, and fets fire to combuftible bodies.

12. *Of the Iris, or Rainbow, and Halos.*

Q. What is the Iris or Rainbow?

A. A beautiful arch in the heavens, ornamented with various colours, which is only ſeen when the ſpectator ſtands with his back to the ſun, and when it rains on the oppoſite ſide. Its colours are, beginning from the upper part, violet, indigo, blue, green, yellow, orange, red.

Q. What was the opinion of the ancients concerning this meteor?

A. Its beautiful colours ſtruck them with amazement. To the philoſophers Pliny and Plutarch, it appeared as an object which we might admire, but could never explain.—The prieſts always preferred the wood, on which the rainbow had appeared to reſt, for their ſacrifices, vainly ſuppoſing that this wood had a perfume peculiarly agreeable to their deities.

Q. How is the rainbow produced, and how does it acquire its beautiful and wonderful form?

A. It is formed by the rays of the ſun being refracted by the drops of falling rain, and thence reflected to the ſpectator's eye.

There are generally two rainbows ſeen at the ſame time: a bright one, and another which is fainter, ſometimes ſcarcely viſible. The *former* is occaſioned by two refractions and one reflection; the *latter* by two refractions and two reflections. The faintneſs of the latter is owing to the double reflection; for there is a loſs of half the light nearly in every reflection.

All the colours of the rainbow may be produced by making the rays of the ſun paſs through a tranſparent priſm of glaſs.

Q. You have ſaid nothing of the rainbows that ſometimes appear by night in the moonſhine;—what think you of them?

A. The *lunar* rainbow is formed in the ſame manner, by the bright beams of the moon ſtriking upon the boſom of a ſhower. A lunar rainbow is a very uncommon ſight.

Q. How do you account for that lucid ring that we ſee diffuſed round the moon, called an halo?

A. As this always appears in a *rimy* or *froſty* ſeaſon, we may ſuppoſe it occaſioned by the refraction of light in the frozen particles of the air.

13. *Of the Aurora Borealis.*

Q. What is the caufe of the Aurora Borealis, or northern lights?

A. This phenomenon is occafioned by the paffage of the electric fluid from one cloud to another. It never appears near the equator, and none are recorded in our annals before that remarkable one in November 1574, nor after that, till March 6, 1716, when one appeared three nights fucceffively. Since that time, however, they have been common. A very remarkable and brilliant Aurora Borealis was feen for fome hours, in the neighbourhood of London, on the evening of the 13th of December 1801.

Q. Where is the Aurora Borealis moft common?

A. It is fcarcely ever feen near the equator, but in the polar regions it is very common. In the Shetland ifles the northern lights are called the "merry dancers:" there they are the conftant attendants of clear evenings, and afford relief amidft the gloom of the long winter nights.

Q. Are they not common in Siberia?

A. In the North-eaftern parts of that country the northern lights are obferved to

begin with single bright pillars, riſing in the north, which, increaſing, comprehend a large ſpace in the heavens, and ruſh about with incredible velocity, till they cover, like a vaſt tent, the expanſe of the heavens, glittering, as it were, with gold, rubies, and ſapphire.

14. *Earthquakes.*

Q. What is an earthquake?

A. An earthquake was formerly ſuppoſed to be occaſioned by the inflammation of ſome ſulphureous and bituminous exhalations contained in the caverns of the earth, not far from its ſurface. Others are of opinion, that earthquakes are not ſo much owing to the exploſion of any ſulphureous matter, or the expanſion of any winds or vapours in the bowels of the earth, as to the electric matter ruſhing along the ſurface of it, and perhaps communicating with that within.

Dr. Stukely was the firſt who advanced this opinion, in ſupport of which he has urged many ſpecious arguments. In the firſt place, he ſays, that in the earthquake which happened at London, on the 20th of September, 1750, and which affected an extent of country,

30 miles in diameter, had it arisen from a subterraneous explosion, it must have moved an inverted cone, or, which is the same thing, a solid body of earth in the shape of a sugar-loaf turned upside down, whose base was 30 miles, and its axis, or depth, 15 or 20 miles; an effect which, he affirms, no natural power could produce.

Nay, in the great earthquake, that happened in Asia Minor, A. D. 17, which destroyed thirteen large cities, and which affected an extent of country 300 miles in diameter, had it proceeded from a subterraneous cause, it must have moved an inverted cone of solid earth 300 miles in diameter, and upwards of 900 in circumference, and about 200 in depth; which, Doctor Stukely says, all the gunpowder which has been made since the invention of it would not have been able to stir, much less any vapours, which could be supposed to be generated so far below the surface.

Add to this, that ships sailing upon the bottomless ocean are affected by an earthquake, in the same manner as if they were standing upon dry land.—They seem to feel as if they had struck upon a rock, or as if something had thumped against their bottom. But this could never be the case did the earthquake arise from a subterraneous explosion at the

bottom of the ſea; for that, at the utmoſt, could only produce a gradual ſwell of the water, and not a ſudden ſhock, like a ſtroke of electricity, as it now does.

Hence he concludes that an earthquake is a ſhock of the ſame kind as thoſe which occur in electrical experiments.

Q. Are there not many ſubterraneous places in the earth from which iſſue torrents of ſmoke and of flames, rivers of melted metals, and clouds of aſhes and ſtones?

A. Yes; they are called *volcanos*; the moſt famous of which are thoſe of mount *Etna* in Sicily, *Veſuvius* in Naples, and *Hecla* in Iceland.

In an eruption from the ſecond of theſe, the two cities of Pompeii and Herculaneum were buried by the lava, and lay concealed in that ſtate for ſeveral ages, till they were lately diſcovered. Pliny the elder, too, the famous naturaliſt, periſhed on the occaſion. Pliny the younger, author of the epiſtles, has given us an account of this cataſtrophe in one of his letters.

The bowels of theſe burning mountains contain ſulphur, bitumen, and other inflammable matter, the effects of which, more dreadful than thoſe of lightning or gunpowder,

have in all ages aſtoniſhed and deſolated the earth.

There was a moſt dreadful eruption of Etna, conſiſting of liquid fire and burning matter, in 1693; it deſtroyed fifteen or ſixteen different towns, eighteen eſtates, and more than 90,000 ſouls.

Within the laſt thirty or forty years there have not been fewer than nine ſeveral eruptions of mount Veſuvius, beſide many preceding ones, ſome of which have been very accurately deſcribed by Sir Wm. Hamilton.

That which happened on the night of the 13th of June, 1794, was preceded by earthquakes, opening firſt in two places, from which iſſued columns of black ſmoke, mixed with liquid inflamed matter; and afterwards more mouths were opened. Exploſions, louder than thunder, with ſharp reports, as from the heavieſt artillery, proceeded from all of them. The lava flowed about four miles in four hours; the greater part of Torre del Greco, a mile from Portici, was thereby deſtroyed, or ſo much injured as to be uninhabitable.

Though 17,000 inhabitants were driven out of the town of Torre del Greco, not more than fifteen lives were loſt there. A promontory of 70 feet high in ſome places, and about

a quarter of a mile broad, has been formed by the lava which ran over the greateſt part of this town into the ſea.

The lava covered and totally deſtroyed about 50,000 acres of rich vineyards and cultivated land; and the temporary damage done to the vineyards on the Somma ſide, and for many miles round, by the aſhes, was immenſe. In ſome places theſe aſhes were not leſs than four feet deep.

15. *Of the Tides.*

Q. Pray what are meant by the tides, or alternate flux and reflux of the ſea?

A. The ſea, like rivers, has its currents, that agitate the waters, and preſerve them from putrefaction. The waters of the ocean have been obſerved regularly from all antiquity to ſwell twice in about five and twenty hours, and as often to ſubſide again: theſe motions are called the tides?

Q. In what time does the tide riſe and fall, or, as it is uſually called, *flow* and *ebb*.

A. In its influx the ſea generally riſes for ſix hours, when it remains, as it were, ſuſpended, and in equilibrio, for about twelve minutes, and that time is called high water.

In its reflux the ſea falls for ſix hours, when it remains, as it were, in a like manner, ſuſ-

pended, and in equilibrio, for about twelve minutes; at that time it is called low water.

In ſome places the tide takes ſeven hours or more in its riſing, and about five or even leſs in its ebbing.

Q. What is the cauſe of theſe wonderful appearances?

A. According to *Sir Iſaac Newton*, they are occaſioned by the attraction of the moon; for the waters immediately underneath the moon will be attracted up in a heap, whilſt the waters on the oppoſite ſide of the earth, being but feebly attracted, will be very light; if they be very light, they alſo will riſe, and all the neighbouring waters flowing into that place, they will ſwell into a heap, or mountain of waters, pointing to the oppoſite part of the heavens. Thus does the moon, in once going round the earth in about twenty-five hours, produce two tides or ſwells, and conſequently as many ebbs.

Q. What is the courſe of the tides?

A. Theſe tides muſt flow from eaſt to weſt, for they muſt neceſſarily follow the moon's motion, which is from eaſt to weſt; but the courſe of the tides is ſome times interrupted by continents, and other large tracts of land. The tide, for inſtance, in the Indian ocean, being ſtopped by the eaſtern coaſt of Africa,

muſt neceſſarily flow ſouth, towards the Cape of Good Hope, which having paſſed, it then runs northward along the weſtern coaſt of Africa, and that of Spain, Portugal, and France, till it enters the Engliſh channel. It there meets the tide from the German ocean, running a contrary way, and is neceſſarily ſtopped, which produces a very great ſwell of water.

Theſe two tides thus flowing in oppoſite directions, and meeting a little irregularly, have ſometimes occaſioned two tides, the one immediately after the other, in the river Thames. Both theſe proceed from the ſame natural cauſe, and conſequently are very eaſy to be explained, though the phenomenon has been looked upon as a prodigy.

Q. Have the rivers any tides ?

A. Yes ; but the tide always flows in a direction the reverſe of the natural ſtream ; for the waters of the ſea being higher, they muſt neceſſarily flow into them, and make their waters flow back or regurgitate. The tide of the Thames, and all the other rivers on the eaſtern coaſt of England, muſt flow weſtward : the tide of the Severn, and of all the other rivers on the weſtern coaſt of England, muſt run eaſtward ; and ſo of the reſt.

LESSON V.

1. *Of Metaphysics.*

Q. WHAT is meant by metaphysics?

A. A science, as the term signifies, more sublime than physics.

Q. What is the difference of these two sciences?

A. Physics treats of natural things, and judges of them from experience. Metaphysics is the science which treats of the powers and operations of the human mind.

2. *Jurisprudence.*

Q. What is jurisprudence?

A. The knowledge of the rights, customs, ordinances, &c. necessary for the administration of justice, being derived from the two Latin words *jus*, right, and *prudentia*, knowledge or skill.

Q. How is right distinguished?

A. Into the *right*, or *law*, *of nature*, the *law of nations*, and the *civil law*.

Q. What is the law of nature?

A. That which nature and reafon have taught men; as the power it gives to fathers and mothers over their children.

Q. In what does the law of nations confift?

A. In public acts and ftatutes which provide for the public utility and neceffity of the people, confidered as a body corporate, and ordain and decree whatever relates to obedience and fubjection, dominion and government, war and peace, contracts, divifions of lands, foundations of focieties, and the conftitution of cities, towns, and villages.

Q. What is the civil law?

A. The civil law is that which is peculiar to any country or people; it is a rule of civil conduct prefcribed by the fupreme power of the ftate, commanding what is right, and prohibiting what is wrong.* When this refpects a city or borough town, it is called their *municipal* law. The profeffors of this fort of law are called civilians.

Q. Specify the feveral kinds of laws now in ufe in England?

A. The laws by which England is governed are, 1ft, *the civil law*, juft mentioned; 2d, *common law*, containing a fummary of all the laws, rights, and privileges of the people of

* Blackftone.

England, in what is called *Magna Charta*, or great charter of Englifh rights; 3d, *ftatute law*, confifting of ftatutes, acts, and ordinances of the king and parliament; 4th, *canon law*, confifting of the canons of general councils, and national and provincial fynods, with the decrees of popes, the judgment of ancient fathers, &c. ufed in ecclefiaftical affairs; 5th, *martial law*, ufed in all military and maritime affairs; 6th, *foreft law*, which relates to the regulations of forefts, and the chace; 7th, to thefe may be added the *law of cuftom*, which is remarkable in fome parts of England.

Q. What requifites are neceffary in the *law of cuftom?*

A. Cuftoms are either general or particular: By GENERAL cuftoms proceedings are guided in the common courts of juftice: PARTICULAR cuftoms affect particular diftricts; but thefe muft be proved to have exifted time *immemorial*, that is, from the time of Richard II.—they muft be *reafonable*, *certain*, *compulfory*, and *confiftent*.

LESSON VI.

1. *Of Medicine and Anatomy.*

Q. IN what does the art of medicine or physic consist?

A. Medicine is the art of preserving health, and of curing or alleviating disease. It is the same science in its application to animal, as agriculture is in part to vegetable life.

Q. What does the science of medicine, or the art of healing include?

A. It includes the *Materia Medica*, or a knowledge of the substances employed, and Pharmacy, or the methods of compounding them.

Q. How is medicine divided?

A. Into theoretic and practical. The theoretic is employed in contemplating the nature of the human body, the diseases to which it is liable, together with those remedies that seem best adapted to restore the functions to their proper state. The practical discovers, by experience, the particulars of each disease, and applies such remedies as are proper to promote a speedy cure.

Q. How may this knowledge of the human body be acquired?

A. By the help of ANATOMY, which is the art of examining bodies by diffection.

Q. What does anatomy teach?

A. By this fcience we obtain a knowledge of the ftructure and functions of the human body; and learn the principles on which life and health depend.

Q. What is meant by human anatomy?

A. I mean a diffection of the human body, which affords an eafy method of examining all its parts, and to difcover what tends either to impair or ftrengthen the conftitution.

Q. What is comparative anatomy?

A. As in human anatomy our refearches are reftricted to our own bodies, fo in comparative, we may range over the whole field of animated nature.

2. *Of Surgery.*

Q. What is furgery?

A. Surgery is that ufeful branch of the healing art which confifts in the manual operations, with proper inftruments, or other external applications to wounds, bruifes, &c.

Q. What diforders demand the furgeon's care, and make the fubject of his art?

A. 1ſt, All kinds of *tumours*, or ſwellings; 2d, *ulcers*; 3d, *inflammations*; 4th, all kinds of *wounds*; 5th, *gangrenes*, or mortifications; 6th, *diſlocations*, or disjointed limbs; 7th, *fractures*, or broken limbs.

Q. What are the proper qualifications of a good ſurgeon?

A. A good ſurgeon ought to be well ſkilled in anatomy, medicine, and other parts of learning: a man of great experience, uncommon dexterity, an unſhaſken courage, a ſteady hand, a clear ſight, quick thought, and of an ingenuous and honeſt mind.

4. *Of Pharmacy.*

Q. What is the other part of phyſic called pharmacy?

A. Pharmacy teaches the art of preparing, compounding, and preſerving medicinals. This ſcience is no more than the profeſſion of apothecaries. Pharmacy comes from the Greek word φάρμακον, which ſignifies a remedy.—The book, directing how ſuch medicines are to be made, is called a *diſpenſatory*.

5. *Of Chemiſtry.*

Q. What is chemiſtry?

A. It is the ſcience which teaches how to inveſtigate the properties and conſtituent parts of bodies, and to reduce compound ſubſtances into their ſimple and elementary parts. It comprehends almoſt all the changes in natural objects with which we are connected and have the greateſt intereſt.

Q. To what practical purpoſes is this branch of ſcience employed?

A. It is ſubſervient to the various arts of life, ſuch as dyeing, bleaching, tanning, glaſs-making, the working of metals, &c.

Q. Can you mention ſome of the more prominent modern diſcoveries in chemiſtry?

A. They are too many to be enumerated; three of the elements of the ancients have been decompoſed by the chemiſts of the preſent age:

Water . .	is found to conſiſt of two gaſes, called	*Oxygen* and *Hydrogen.*
Air	is compoſed of two gaſes alſo, viz.	*Oxygen* and *Nitrogen.*
The *Earths* are compoſed of		*Oxygen* and a *Metallic Subſtance.*

So likewiſe are the alkalies, ſulphur, and other ſubſtances formerly deemed ſimple, the metallic baſes being different, in all the different ſubſtances. A great variety of new and curious gaſes have been diſcovered; and ſeveral new metallic ſubſtances.

6. *Of Botany.*

Q. What is underſtood by botany?

A. As a modern ſcience, botany chiefly applies to the claſſification of plants, by which, from general characters, the claſs, order, genus, and ſpecies of each plant may be known.

Botany, as a branch of phyſical knowledge, treats of plants, herbs, and vegetables, and deſcribes their nature, kinds, and uſes in medicine, and other affairs of life. The word botany is derived from a Greek word, which ſignifies an herb. A book on this ſubject is called an herbal; and a profeſſor of this art or knowledge is called a *botaniſt* or *herbaliſt*.

Q. Is botany very neceſſary to a phyſician?

A. Yes; for it includes the knowledge of all medicinal plants, without which it would be impoſſible for him to uſe them, but at a

very great hazard of the life of the ſick perſon, or, at the leaſt, doing him a great injury.

Q. How do you come at a knowledge of the anatomy of vegetables?

A. By beginning at the external covering, called the *epidermis* or cuticle; thence deſcending to the *cellular integument*, which is the ſeat of colour; then to the *bark*, which in young plants conſiſts of a ſingle layer, but in older ones of as many layers as they are years old: under the bark is the *wood*, which forms the great bulk of trees and ſhrubs, and which conſiſts of layers; and in the centre of the wood is the *medulla* or pith.

LESSON VII.

The Languages.

Q. WHAT is language?

A. Language is a ſet or collection of ſounds or notes made uſe of by any nation or people to expreſs the ideas of their mind, and by this means to render their thoughts intelligible to each other; and this communication of our ſentiments to others is called ſpeech, or ſpeaking.

Q. Whence comes the great number and diverſity of languages?

A. From the building of the Tower of Babel; Geneſis, chap. xi.

Q. How many original languages, or, as they are commonly called, mother tongues, are there in the world?

A. 1. The Hebrew; 2. the Greek; 3. the Latin; 4. the old Gothic.

Q. What are the properties of the Hebrew?

A. The chief properties of the Hebrew are 1ſt, that its letters are twenty-two, of which we have a ſtatement in the following table.

The Name.	*num.	form	Finals†.	simls.	Sound or Power.
Aleph	1	א			a *broad, as in* war
Beth	2	ב		כ	b
Gimel	3	ג		ג	g *hard, as in*
Daleth	4	ד		רך	d [give, get
He	5	ה		הח	e, *as in* where
Vau	6	ו		ןזי	u, *as* oo, w *before*
Zain	7	ז			z [*a vowel*
Heth	8	ח		ת	h *hard aspirate*
Teth	9	ט		סמ	th
Yod	10	י			i *like* ee
Caph	20	כ	ך 500		k or c, *hard,* as
Lamed	30	ל			l [come
Mem	40	מ	ם 630		m
Nun	50	נ	ן 700		n
Samech	60	ס		ם	ſh
Oin	70	ע		עצ	o *long, as* whole
Pe	80	פ	ף 800		p
Jaddi	90	צ	ץ 900		j *ſoft, as* s *in* trea-
Koph	100	ק			q *or* qu [ſure
Reſh	200	ר			r
Shin or Sin	300	ש			s
Tau	400	ת			t

Of theſe letters five are vowels, namely, צ י ו ח א; all the reſt are conſonants.

* That is, numeral power or import, an arithmetical mark.

† Letters thus written at the *end* of a word.

2d, That many words occur without any of the vowels, which may be pronounced as if a ſhort *e* or *a* ſtood between the conſonants; as דבר DBR, pronounced *Deber*, or *Dabar*; פקד PQD, *pequed* or *Paquad*. 3d, That moſt feminine nouns end in ה or ת, moſt others are maſculine. 4th, That the plural maſculine is formed by adding ים, and the plural feminine by adding ות to the ſingular. 5th, That the verbs have only *two tenſes*, *paſt* and *future*, and *two genders*, *maſculine* and *feminine*. 6th, That Hebrew is read from the right hand to the left and not from the left to the right, as the Engliſh and other weſtern languages. 7th, That from the Hebrew ſprang the Chaldee, the Syriac, the Arabic, the Samaritan, and the Ethiopic. The Arabic is the moſt copious, having a thouſand different words for a ſword, five hundred for a lion, and two hundred for a ſerpent.

Q. What are the properties of the Greek language? *

A. 1ſt, It has a wonderful copiouſneſs of words. 2d, It is a language which abounds in compounds and derivations. 3d, It enlarges and ennobles the human mind, by

* The Greek and Latin alphabets are purpoſely omitted, as they are in the hands of every ſchool-boy.

laying open the writings of the Greek philosophers, poets, and historians.

Q. What languages have had their rise from the Latin?

A. The Latin can boast of a noble progeny; she gave birth to the Italian, French, Spanish, Portuguese, and a great part of the English.

Q. What are the daughters of the old Gothic tongues?

A. The two great branches, the Teutonic and Saxon languages; from whence all the northern tongues had their beginning; as the Swedish, Danish, Norwegian, high and low Dutch, Flemish, Scots, and English.

Q. Who invented that orderly arrangement of the letters which we call by the Greek name alphabet?*

A. Cadmus, king of Thebes, son of Agenor, king of Phœnicia, in the year of the world 1620.

The Hebrews, struck with admiration at this art, have called it *Dikduk*, that is, subtle invention.

Q. What anecdotes are mentioned in connection with books and letters?

A. The Americans, when they first saw a person read from a book, believed that the paper spoke.

* From *Alpha*, *Beta*, the two first Greek letters.

We are told that an Indian ſlave, being ſent by his maſter with a baſket of figs and a letter to a gentleman, ate on the way part of the fruit, and delivered the reſt with the letter. The gentleman having read the letter, and not finding the quantity of figs it mentioned, accuſed the ſlave of eating thoſe miſſing, and read him the letter; but the poor Indian proteſting his innocence, curſed the paper, and accuſed it of falſe evidence.

Some time afterwards he was ſent again on the ſame commiſſion, with a letter that expreſsly marked the number of the figs he was to deliver. On the way he again ate a part as before, but with this precaution, that he might not be again accuſed, he firſt hid the letter under a large ſtone, moſt firmly believing, that if it did not ſee him eat the figs, it could not poſſibly be a witneſs againſt him. But the poor miſerable wretch, accuſed more than ever, confeſſed the crime, and held in admiration the virtue of the paper.

Grammar.

Q. What is grammar?*

A. Grammar is the art of rightly expreſſing our thoughts by words.

* From the Greek word *Gramma*, a letter.

Q. How many ſorts of words are there?

A. Nine; 1ſt, the article *(a)*; 2d, noun *(b)*; 3d, pronoun *(c)*; 4th, adjective *(d)*; 5th, verb *(e)*; 6th, adverb *(f)*; 7th, prepoſition *(g)*; 8th, conjuction *(h)*; 9th, interjection *(i)*. Theſe are commonly called parts of ſpeech.

Q. What are the rules of grammar?

A. In living languages, as the Engliſh, French, Italian, &c. uſe is the beſt rule: in

(a) From the Latin word *articulus*, a joint or ſmall part.

(b) From *nomen*, a name; it expreſſes the name of any perſon, place, or thing; as John, London, Goodneſs.

(c) From *pro*, for, and *nomen*, a noun, from its being uſed inſtead of a noun, to avoid the two frequent repetition of the ſame word.

(d) From *ad*, to, and *jacio*, to put; and ſignifies the quality of a perſon, place, or thing; as a *good* man, a *great* city, a *fine* horſe.

(e) From *verbum*, a word; a verb being the principal word in a ſentence.

(f) From *ad*, to, and *verbum*, a verb, and expreſſes the quality of a verb.

(g) From *præ*, before, and *pono*, to place, from its being ſet before nouns and pronouns.

(h) From *con*, with, and *jungo*, to join, is a part of ſpeech that joins words or ſentences together.

(i) From *inter*, between, and *jacio*, to throw, is a word that expreſſes any ſudden motion of the mind.

the dead languages, as the Latin, Greek, &c. the rules are fixed.

Q. Is the ſtudy of the grammar of one's own country neceſſary?

Q. Moſt certainly it is; for a competent grammatical knowledge of our own language is the true foundation upon which all literature, properly ſo called, ought to be raiſed. Ignorant of the principles of grammar, we ſhould be entire ſtrangers to the delicacies of the language of our own country, and unable to expreſs ourſelves on the moſt trifling occaſions properly, correctly, or politely.— What, for inſtance, is more common than to hear ignorant people ſay, *I loves*, *I knows*, *I ſees*, inſtead of I love, I know, I ſee; and committing a thouſand other grammatical errors? Even our beſt poets ſometimes fall into ſuch blunders, as Mr. Prior evidently does in the following lines:—

Once more at leaſt look back, ſaid I;
'Thyſelf in that large glaſs deſcry:
When thou art in good humour dreſt,
When gentle reaſon rules thy breaſt,
The ſun upon the calmeſt ſea
Appears not half ſo bright as *thee*—[inſtead of *thou*.]

Q. Is the ſtudy of grammar difficult?

A. It is ſo in the Greek and Latin, an even in the French and ſome other moder languages, which have a great number o irregular verbs. But in Engliſh it is ver eaſy, and therefore ſoon may, and indee ought to be, learned by every young perſon.

Q. What is punctuation?

A. Punctuation is the art of making i writing the ſeveral pauſes or reſts betwe ſentences, and the parts of ſentences, accor ing to their proper quantity or proportio as they are expreſſed in a juſt and accura pronunciation.

Q. What marks are uſed for this purpoſe?

A.

	Thus marked
The period	.
The colon	:
The ſemicolon	;
The comma	,
The interrogation	?
The exclamation	!
The parentheſis	( )

LESSON VIII.

1. *Of Rhetoric and Oratory.*

Q. WHAT is rhetoric?

A. The art of expreſſing ourſelves well, and ornamentally, on any ſubject; to pleaſe, to touch the paſſions, and to perſuade, whether in ſpeaking or writing. A ſpeech made according to the rules of this art is called an *oration*, and the ſpeaker an *orator*.

Q. What are the qualifications of a good *orator?*

A. It is neceſſary that he ſhould have the following requiſites:

1. *Invention*, by which he finds out ſuch reaſons and arguments as are adapted to perſuade and gain belief.

2. *Diſpoſition* or *Order*, that he may know how to diſpoſe or arrange his arguments in a proper order or method.

3. *Elocution*, which is a clear and neat manner of expreſſion, and is embelliſhed with tropes and figures.

4. *Memory*, which is the power of the mind to retain the things he has learnt, till he ſhall be in want of them.

5. *Pronunciation*, which relates to the delivery of a difcourfe or oration in a diftinct and agreeable manner; with a pleafing modulation of voice, and becoming gefture of the body: Of all the qualifications of a good orator, *this* is certainly the moft ufeful.

Q. You have mentioned tropes and figures, pray explain them to me.

A. A *trope* is an elegant and beautiful turning of a word from its proper fignification to another. As, Charity is *cold*—You read *Virgil*, i. e. his writings—The clouds drop *fatnefs*, &c.

Q. What are figures?

A. The figures of fpeech render a compofition fine and beautiful: fome regard the *meaning* of words; as, if we *ride*, let's ride, i. e. pufh on; fome the *found*, as, he is not a *friend*, but a *fiend*; fome the *order*, as *meats* are for the belly, not the belly for *meats*; fome relate to *fentences*, as, they change their *foil*, not their *minds*, who plough the main.

Q. How many parts has an oration?

A. Five; 1ft, the *exordium*, or beginning of the difcourfe; 2d, the *narration*, which confifts in a recital of facts; it ought to be *true*, or at leaft *probable*, *confpicuous*, and *concife*; 3d, the *confirmation* or arrangement of the proofs in an order moft likely to perfuade; 4th, *confutation*,

for when the orator has confirmed his own arguments, he naturally then proceeds to confute and diſprove thoſe of his adverſary; the confutation ought to be lively; 5th, the *peroration*, or, as it is ſometimes called, epilogue, is a recapitulation of the principal arguments. The peroration ought to excite the feeling of hatred or pity, according to the nature of the ſubject, in the minds of the perſons to whom the oration is addreſſed.

Q. As it is ſo deſirable a thing to be able to read and ſpeak with propriety, give me, if you pleaſe, ſome practical and eaſy rules by which this accompliſhment may be acquired?

A. The rules that appear to be beſt adapted to form a correct and graceful ſpeaker, are,

1. Aim at nothing higher, till you can read diſtinctly and deliberately.

> Learn to ſpeak ſlow, all other graces
> Will follow in their proper places.

2. Let your pronunciation be bold and forcible.

3. Acquire a compaſs and variety in the height of your voice.

4. Pronounce your words with propriety and elegance.

5. Pronounce every word, conſiſting of more than one ſyllable, with its proper *accent*.

6. In every ſentence diſtinguiſh the more ſignificant words by a natural, forcible, and varied emphaſis.

7. Acquire a juſt variety of pauſe and cadence.

8. Accompany the emotions and paſſions which your words expreſs, by correſpondent tones, looks, and geſtures.

2. *Of Poetry.*

Q. What is poetry?

A. A ſpeaking picture, which repreſents in verſe the life and actions of a perſon; and a poem is a complete and finiſhed piece of poetry.

Q. What ſort of verſes are chiefly uſed in our poetry?

A. Thoſe of ten, eight, and ſeven ſyllables. The common meaſure of heroic and tragic poetry conſiſts of ten ſyllables, as

Think of thy Father, and his face behold!
See him in me, as helpleſs and as old!
Though not ſo wretched; there he yields to me,
The firſt of men in ſov'reign miſery;
Thus forc'd to kneel,—thus grov'ling to embrace
The ſcourge and ruin of my realm and race,
Suppliant my children's murderer to implore,
And kiſs thoſe hands yet reeking with their gore.

Second, of eight, which is the ufual meafure for fhort poems.

And may at laft my weary age
Find out the peaceful hermitage,
The hairy gown, and moffy cell,
Where I may fit, and nightly fpell
O'er ev'ry ftar the fky does fhew,
And ev'ry herb that fips the dew.

Third, of feven, called Anacreontic, from Anacreon, a Greek poet, who wrote in verfe of this meafure.

Faireft piece of well-form'd earth,
Urge not thus your haughty birth.

Q. Which are the kinds of poetry moft in ufe?

A. The kinds of poetry are various: the moft confiderable forts are, 1ft, *Paftoral,* which defcribes a fhepherd's life and bufinefs, or that of rural nymphs and fwains. 2d, *Elegy*, is a mournful poem, or funeral fong. 3d, *Lyric Poetry*, is generally ufed in the compofition of fongs and odes. 4th, *Pindaric* ode (fo called from its inventor Pindar) is a fort of poetry which confifts of loofe and free numbers, and unequal meafures. 5th, *Satire*, is a free, jocofe, witty, and fharp poem, feverely inveighing againft vice and all cor-

rupt manners and perſons. 6th, *Comedy*, is an agreeable imitation of the actions, humours, and cuſtoms of common life. 7th, *Tragedy*, in which the calamities of illuſtrious men are repreſented and acted over again. 8th, *Epic* or *Heroic Poem*, is a poetical narration in blank verse of ſome illuſtrious and important actions of the hero celebrated in the poem; as the great exploits of Achilles in the Iliad of Homer. 9th, *Epigram*, is an inferior ſort of poem, whoſe peculiar character is brevity, beauty, and a ſharp turn of wit at the end.

LESSON IX.

1. *The Mathematics.*

Q. WHAT is meant by the mathematics?

A. A ſcience that contemplates whatever is capable of being numbered or meaſured. It ranks the firſt of all ſciences, becauſe it conſiſts only in demonſtration.

Q. Of what uſe are the mathematics?

A. They open and extend our ideas, ſtrengthen and improve our underſtandings, fix our attention, and, by giving us a juſt habit of reaſoning, prepare us for all other kinds of ſtudies, and the important employments of life.

2. *Arithmetic.*

Q. What is arithmetic?

A. The art of computing by numbers.— Addition, ſubtraction, multiplication, and diviſion, are its principal rules, all the others ariſing only from different applications of them.

Q. What does addition teach?

A. To add many ſums together, to know their total value.

Example.

	3	22	55	68
	4	5	9	91
	43	48	44	70
	4	7	30	7
	12	36	3	86
make	66	118	141	322

which are the total amounts of thoſe numbers.

Q. What is ſubtraction?

A. A rule teaching us to take a leſs number from a greater, to ſhew what remains.

Example.

From	9	58	503	480
Take	4	49	287	391
Remain	5	9	216	89

which are the numbers demanded.

Q. What is the uſe of multiplication?

A. It teaches us to increaſe the greater of two numbers given, as often as there are units in the leſs.

Example.

Multiply	15	25	206
by	4	8	12
They will produce	60	200	2472

which are the third numbers required.

Q. What is the fourth rule of arithmetic?

A. Divifion, which teaches to find how often one number is contained in another; or to divide any number into what parts you pleafe.

Example.

Divide	28 by 4	The answer will be	7
	240 8		30
	2472 12		206

Q. What are the other rules of arithmetic?

A. Reduction, rule of three, practice, allegation, fellowfhip, extraction of roots, intereft, and whatever relates to annuities, penfions, &c. with every thing concerning commerce, and merchants' accounts.

Q. To whom is this fcience neceffary?

A. To every perſon. It forms the mind, and diſpoſes it to reaſon juſtly on all other ſciences. It teaches us to ſet our affairs in order. In a word, arithmetic is the ſoul of commerce, and the mother of all the ſciences.

3. *Commerce.*

Q. What is commerce?

A. The art of exchanging one thing for another, or buying or ſelling merchandize, &c. with an intention to gain.

Q. Has commerce been a long time carried on?

A. It appears to be as ancient as the world. At firſt it conſiſted in nothing more than the exchange of things neceſſary for life, as it is at preſent practiſed on the coaſts of *Siberia*, *Norwegian Lapland*, and *Ruſſian Lapland*; among the different nations of *Africa* and *Aſia*, and in many parts of *America*: money was not in uſe at that time.

Q. What nations have made themſelves moſt famous by their commerce?

A. The Phœnicians, Egyptians, Carthaginians, Athenians, Rhodians, Romans, Gauls, and Flemings; at preſent the Engliſh, Dutch,

Venetians, and Genoeſe, carry on the moſt extenſive commerce.

4. *Geometry.*

Q. What is geometry?

A. A ſcience teaching the menſuration of quantity in all its extents, length, breadth, and thickneſs.

Q. What is the meaning of the word geometry?

A. It is derived from the Greek, and ſignifies the art of meaſuring the earth. It had its riſe among the Egyptians, who were, in a manner, compelled to invent it to remedy the diſorders occaſioned in their lands by the annual overflowings of the river Nile, which defaced every boundary.

Q. How is quantity diſtinguiſhed?

A. Into lines, ſuperfices, and ſolids.

Q. What is a line?

A. A line is formed by the motion of a point; and therefore is one dimenſion only, i. e. length.

Q. How is a ſuperfices generated?

A. By the motion of a line, and ſo hath two dimenſions, i. e. length and breadth.

Q. How is a ſolid produced?

A. By the motion of a ſuperſices, and hath three dimenſions, length, breadth, and thickneſs.

Q. How is geometry divided?

A. Into three principal parts.

1. *Altimetry*, which is applied to the meaſuring all heights, acceſſible or inacceſſible.
2. *Planimetry*, which teaches the menſuration of ſurfaces in ſquare meaſures, ſuch as ſquare miles, yards, feet, inches, &c.
3. *Stereometry*, which is the menſuration of all kinds of ſolid bodies in ſolid or cubic meaſures, as cubic feet, cubic inches, &c. This alſo includes *guaging*, or the art of finding the contents of any caſk or veſſel, or the quantity of liquor contained in them: alſo the meaſuring of timber, &c.

LESSON X.

1. *Architecture.*

Q. WHAT is architecture?

A. The art of building or raising all kinds of edifices; as houses, churches, palaces, &c. and it is distinguished into three parts;—civil, military, and naval.

Q. In what does civil architecture consist?

A. In external ornaments and internal conveniencies.

Q. What are the orders of civil architecture?

A. They are generally reckoned five? 1. The Tuscan; 2. the Doric; 3. The Ionic; 4. The Corinthian; and 5. The Composite. To these may be added the Gothic, which is an old method of building, still preserved in the construction of almost all cathedral churches. These orders take their names from the people who invented them.

Q. In what does military architecture, or fortification, confift ?

A. In conftructing fuch works about a town, &c. as will enable a fmall number of men within to withftand, for a confiderable time, the affaults of a greater number without. A town fortified is called a *fortrefs*.

Q. What is naval architecture ?

A. The art of conftructing veffels, whether for the fervice of war or commerce. This art has, within the laft twenty or thirty years, been carried to a confiderable degree of perfection in this country. A fociety, patronized by the principal characters in the kingdom, has been inftituted for the purpofe.

The architect fhould be a good draftfman, and well acquainted with the fciences.

2. *Painting.*

Q. What is painting ?

A. An art teaching us by drawing, and the application of colours, to reprefent all forts of objects. The principal departments in this branch of art are, portrait, landfcape, and hiftorical paintings.

Q. How many forts of paintings are there ?

A. Five: 1. In oil; 2. In frefco; 3. In water-colours; 4. On glafs; and 5. In enamel; to which may be added miniature and paftel. Painting in oil was unknown to the ancients. The art has received the greateft advantage from this difcovery.

Q. What are the qualifications of an excellent painter?

A. He ought to underftand drawing in its higheft perfection. He ought to have a complete knowledge of anatomy and geometry. He ought to read a great deal, to have a great judgment, patience, and a highly cultivated tafte: he ought to be fober, and fond of his art.

3. *Sculpture.*

Q. What is fculpture?

A. The art of carving, or hewing ftone into images. Every thing that is engraved or worked in relievo makes a part of this art.

Its antiquity appears from many places of the holy fcripture—from the idols of Laban that Rachael carried off, and from the golden calf fet up by the Ifraelites in the defert.

4. *Optics.*

Q. What is optics?

A. Optics is the ſcience of viſion, whether natural, as performed in the eye, or artificial, as affected by inſtruments.

Q. How is viſion produced?

A. Viſion, or the ſenſe of ſight, is in all caſes produced by the action of the rays of light upon the expanſion of the fine *optic nerve* in the eye, called the *retina.*

Q. Pray what do you call light?

A. By means of the rays of light we have the power of perceiving external objects. Light, therefore, is that medium which renders the organs of ſight uſeful.

Q. Is not the ſun the fountain of light?

A. Yes; but in what manner that great body is fed with continual fuel to keep up his force is not known; whether comets travel from other ſyſtems with a proviſion of this nature, or whether the ethereal vapours come from all parts with their ſupply, cannot be aſcertained.

Q. Is it known how long a ray of light is upon its journey, in travelling from the ſun to enlighten our hemiſphere?

A. Yes; eight minutes, though the diſtance is ninety-five millions of miles; conſequently light travels at the rate of two hundred thouſand miles in a ſingle ſecond, which is upwards of a million times ſwifter than a ball from the mouth of a cannon.

5. *Mechanics.*

Q. What is mechanics?

A. That ſcience which teaches the nature and laws of motion, the action and force of moving bodies, and the conſtruction and effects of all thoſe machines and engines which go by the name of mechanic powers.

Motion is a continual and ſucceſſive change of place; and reſt is the continuance of a body in the ſame place for any time.

Q. What is meant by a mechanic power?

A. Any machine or engine by which a man can raiſe a greater weight, or overcome a greater reſiſtance, than he could do by his natural ſtrength without it.

Q. How many mechanic powers are there?

A. They are ſaid to be ſix in number; namely, the *lever*, by which we lift weights much greater than we could by our unaſſiſted

ſtrength; the *axle* and *wheel*, by which we can lift them to greater heights; the *pulley* lifts them higher ſtill; the *ſcrew*, which, if it could move without friction, would give a greater force than any of the reſt; the *wedge*, uſed in cleaving wood, &c. and the *inclined plane*, by which heavy bodies are rolled up with greater eaſe. Of theſe all the moſt compound engines now conſiſt, from the ſteam engine downwards, as clocks, watches, orreries, &c.

LESSON XI.

Of the Division of Time, or Chronology.

"A little chronology will be highly uſeful." KNOX.

Q. WHAT is chronology?

A. A ſcience that teaches the method of meaſuring time, and diſtinguiſhing its parts.

Q. What is meant by time?

A. Time is the duration of things: its parts are centuries, years, months, weeks, days, hours, minutes, ſeconds, &c. and by theſe the larger and leſſer intervals of time are eſtimated and meaſured.

Q. What is a century?

A. A century is a courſe of a hundred years, and eſtimated frequently at three ages.

Q. What is a year?

A. A ſpace of twelve months, which is the time the ſun takes in paſſing through the twelve ſigns of the zodiac.

Q. What is the zodiac?

A. A circle, ſhewing the earth's annual path through the heavens. On this circle are marked the twelve ſigns, which are numbers of ſtars reduced by the fancy of men into the

forms of animals, and may be deſcribed in order thus:

> The *ram*, the *bull*, the *heav'nly twins*,
> And next the *crab*, the *lion* ſhines,
> The *virgin* and the *ſcales*;
> The *ſcorpion*, *archer*, and *ſea goat*,
> The man that holds the *water pot*,
> And *fiſh* with glittering tails.

Q. What is a month?

Q. A month is juſt the time wherein the moon is going round the earth, which revolution ſhe performs in twenty-ſeven days, ſeven hours, and forty-three minutes; ſo that there are twelve lunar months in a year, and about eleven days more, though, for conveniency, and greater regularity, they are made but twelve in our almanacks, by adding a greater number of days to each month than it really contains.

Q. How many weeks are there in a year?

A. Fifty-two, and ſeven days in each week.

Q. How are the days named?

A. Sunday, Monday, Tueſday, Wedneſday, Thurſday, Friday, and Saturday. To theſe days the Pagans gave the names of the ſun, moon, and planets: to the firſt the name of the ſun, to the ſecond of the moon, to the third of Mars, to the fourth of Mercury, to

the fifth of Jupiter, to the ſixth of Venus, and to the ſeventh of Saturn.

Q. Do all nations reckon them in the ſame order?

A. No; the Chriſtians count from Sunday, in memory of the reſurrection of our Saviour, the Jews from Saturday, the Mahometans from Friday.

Q. What is a day?

A. A day is either artificial or natural.—The natural day contains twenty-four hours; the artificial, only the time from ſun-riſe to ſun-ſet: the natural day is divided into two parts, night and day, properly ſo called.

Q. When do we begin the day?

A. The Engliſh, French, Dutch, Germans, Spaniards, Portugueſe, and Egyptians, begin the day at midnight: the Greeks and Jews, with the modern Italians and Chineſe, begin it at ſun-ſetting: the ancient Babylonians, Perſians, Syrians, with the modern Greeks, at ſun-riſing; and the Arabians, and modern aſtronomers, begin it at noon.

Q. What is an hour?

A. An hour is the 24th part of a natural day, and ſhewn by clocks and watches. It is divided into ſixty equal parts, called minutes, and theſe again into ſixty equal parts, called ſeconds.

Q. What is meant by the ſeaſons of the year?

A. The changes and varieties which happen in nature by the yearly revolution of the earth round the ſun: theſe are divided into SPRING, commencing about the 21ſt of March; SUMMER, about the 21ſt of June; AUTUMN, about the 21ſt of September; and WINTER, about the 21ſt of December.

Q. When is the length of the day and night equal?

A. This happens twice every year; once about the 21ſt of March, and again about the 22d of September. Both theſe times are called the equinoxes.

Q. How do we call the light that appears before the riſing and after the ſetting of the ſun?

A. The light ſeen before the ſun, is called Aurora, and after he ſets, the twilight; which latter name is frequently applied to both.

Q. What do we call the dog days?

A. Thoſe intenſely hot days between the 3d of July and the 11th of Auguſt; anciently the ſtar called the great dog ſtar, during that period, was obſerved to riſe and ſet with the ſun, and from thence the name was given.

Q. When are the longeſt and ſhorteſt days?

A. The longeſt is about the 21ſt of June, at the beginning of ſummer, after which they begin gradually to decreaſe; and the ſhorteſt is about the 21ſt of December, at the beginning of winter, after which they begin gradually to increaſe.

Q. Is this change the ſame in every part of the earth?

A. No: it is more or leſs, according as the country is ſituated farther from, or nearer to the equator. There are, for example, ſome countries where the length of the day and night is always exactly the ſame; others where the night, during the ſummer ſeaſon, is only an hour; others where the night continues always ſix months, and the day as many. This variety in the length of the day and night is illuſtrated by the globe.

Q. What other name is given to the 21ſt of June?

A. The ſummer ſolſtice, becauſe then the ſun ſeems to ſtand ſtill in his journey towards the north, before he begins to return ſouthward; that is, he ſeems at twelve o'clock at noon to be exactly at the ſame height in the heavens for ſeveral days together.

Q. And what other name to the 21ſt of December?

A. The winter ſolſtice, becauſe then the ſun

ſeems to ſtand ſtill in the courſe towards the ſouth, before he begins to return northward.

Q. What are the names of the twelve months in their order?

A. January, February, March, April, May, June, July, Auguſt, September, October, November, December.

Q. How many days does each of theſe months contain?

A. Seven hath thirty-one days; January, March, May, July, Auguſt, October, and December. Four have thirty days; April, June, September, and November; and one alone, February, has twenty-eight or twenty-nine. According to theſe verſes:

> Thirty days hath September,
> April, June, and November;
> February twenty-eight alone,
> All the rest have thirty-one;
> But when leap-year comes, in that time
> Hath February twenty-nine.

Q. How did the Romans divide their months?

A. Into calends, nodes, and ides; calling the firſt day of every month its calends.

Q. How many days are there in a year?

A. Three hundred and ſixty-five.

Q. Is this number always the ſame?

A. No: it changes every four years, and the fourth year, which is called Biſſextile, or leap year, has always one day more.

Q. How comes this change?

A. Every year consists of six hours nearly over the 365 days. These six hours in four years amount to one whole day, which is then added at the end of February; on this account it is that this month has twenty-nine days once in four years.

Q. Did the Romans reckon their months like this?

A. No: they had first only ten, afterwards they addded two, but they always began their year at March.

Q. Who were the two great reformers of the calendar?

A. Julius Cæsar and Pope Gregory XIII.

Q. What is an olympiad?

A. A space of four years. The ancient Greeks reckoned in this manner, because they celebrated at the beginning of every fifth year their games, which were contests in all the manly exercises, such as wrestling, boxing, running, chariot races, &c. in a plain near the town of Olympias; for this reason they were called Olympiads. They were first instituted by Hercules in honour of Jupiter, 776 years before Christ.

Q. What is an epoch?

A. An epoch is a certain point of time from which historians begin to reckon; as the

creation of the world, the building of Rome, the birth of Chriſt, the deſtruction of Jeruſalem, &c. It alſo marks the time from one remarkable event to another. It is, for example, an epoch from the creation of the word to the deluge, &c.

Q. What is a luſtrum?

A. A ſpace of five years, uſed only by the Roman poets.

Q. What is a jubilee?

A. A public feſtivity; one of which was kept on the 25th of October, 1809, being the fiftieth anniverſary ſince his Majeſty's acceſſion to the throne?

Q. What is an indiction?

A. A revolution of fifteen years, uſed only by the Romans, for indicating the times of certain payments made by the ſubjects to the republic. It was eſtabliſhed by Conſtantine, in the year 312.

Note.—According to the æra by which we reckon, we date the time of every memorable tranſaction; as,

A. M. i. e. *Anno Mundi*, the year of the world.

A. D. i. e. *Anno Domini*, the year of our Lord.

Ab U. C. i. e. *ab urbe condita*, from the building of the city of Rome; and ſo of the other epochs.

For example, we ſay,

Noah's flood happened	A. M. 1656.
The Kings were expelled, and Conſular government eſtabliſhed at Rome,	ab U. C. 246.
Charlemagne was crowned Emperor of the Weſt,	A. D. 800.

LESSON XII.

Cofmography, or the Univerfe.

Q. WHAT is cofmography?

A. A defcription of the world; that is, of the heavens and the earth; in a word, of the whole univerfe.

Q. How is cofmography divided?

A. Into two parts; aftronomy and geography.

Q. What is the ufe of aftronomy?

A. It gives us the knowledge of the heavenly bodies, and teaches us, from the regularity of their motions fince their creation by God, that there is an infinite power who directs their courfes, according to the order he has eftablifhed.

Q. How is this fcience moft eafily acquired?

A. As the figure of the world is round, we make ufe of two globes, one called the cœleftial, upon whofe furface are painted the ftars, reduced to conftellations, with the circles of

the ſphere; and the other the terreſtrial, which ſhews us upon its ſurface a deſcription of the land and water.

Q. What do you call the heavens?

A. Thoſe regions that we ſee lying all around us above the atmoſphere, in which are ſituated the ſun, moon, planets, and fixed ſtars.

Q. What is the atmoſphere?

A. A thin fluid maſs of matter which ſurrounds the earth. Its uſe is not only to ſuſpend the clouds, which furniſh rain, and ſerve for the common purpoſes of breathing; but it is alſo the cauſe of the morning and evening twilight, and all the glory and brightneſs of the firmament. It is extremely difficult to determine its exact height. Were it all as denſe as it is near the ſurface of the earth, it would not exceed ſix miles. In general, however, it is ſuppoſed to be about forty-five, or fifty miles in height; for the higher it goes the thinner and lighter it becomes, and a ſmaller quantity of it occupies a larger ſpace. We may juſtly ſay that the atmoſphere ſerves as a covering to the earth.

Q. What is the ſun?

A. That glorious luminary created by God as the ſource of light and heat to the world.

Q. Is the nature of the ſun known?

A. No; ſome imagine it to be a body of fire; ſome have imagined it to be the place of hell; and others ſay it is a vaſt world adapted for the abode of innumerable beings, who enjoy in it abundant means of happineſs.

Q. Is the ſun larger than the earth?

A. Yes; it is more than a million of times larger. It appears ſo ſmall as it does on account of its diſtance, which is ſo great, that a cannon ball would be little leſs than thirty years coming from thence to the earth, even if it travelled as ſwift as it does when it is firſt diſcharged from the mouth of the cannon.

Q. Does the ſun move, or is he always fixed?

A. It was formerly ſuppoſed that he moved, becauſe he ſeemed to do ſo. But it is now demonſtrated that he always remains fixed in the ſame place, and that it is the earth that moves round about him.

Q. Does the ſun afford us any other benefit but that of light?

A. Yes; it ripens the fruits of the earth by its heat.

Q. Why is not the ſun always viſible after it riſes?

A. A thick cloud will ſometimes conceal it from our view, by interrupting its rays. Of this we may eaſily be convinced: if we ſtand

upon the top of a high mountain above the clouds, the ſun will then be viſible, while it is totally hidden from thoſe in the valley below.

Q. What is the moon?

A. A large globe like our earth in matter and form, deſigned to enlighten us by night.

Q. Is the moon a luminary like the ſun?

A. No: it is a dark opaque body, and receives all the light ſhe ſhines with from the ſun, and by reflection conveys it to us in the ſun's abſence.

Q. How do we call the different degrees of light with which ſhe ſhines?

A. Her phaſes. At NEW moon ſhe is between the ſun and the earth, and her enlightened parts are hidden or turned from us; when FULL, we are between her and the ſun, and we ſee all her enlightened ſide: ſhe likewiſe appears in the courſe of her journey a HORNED, HALF, and GIBBOUS moon, according to the quality of her enlightened diſk that is viſible to us.

Q. What is the reaſon that ſome parts of the moon's face look duſky, and others light?

A. The bright parts of the moon's body are the higheſt parts of land, which reflect the light of the ſun, as hills, mountains, promontories, iſlands, &c. and the darker parts of the moon are caverns, deep pits, and places

which do not reflect the ſun's light ſo ſtrongly as others.

Q. Is the moon larger than the earth?

A. No; the earth is at leaſt fifty times bigger than the moon. The moon travels round the earth at the diſtance of about two hundred and forty thouſand miles.

Q. What influence has the moon?

A. To the earth ſhe is the cauſe of the tides, for by attracting the waters of the ſea, ſhe raiſes them higher than their natural level.

Q. What elſe is obſervable of the moon?

A. That ſhe is inhabited: for to what end elſe can the diſtribution of land and water, mountains and valleys, ſerve, but, as on our earth, to nouriſh and ſuſtain living creatures.

Q. How are the ſtars diſtinguiſhed?

A. Into *fixed* ſtars; and *planets*, or moving ſtars: the fixed ſtars are ſuppoſed to be ſo many ſuns, like ours, having planets, or habitable worlds, moving round them.

Q. What is their number?

A. They are ſuppoſed to be numberleſs.—No more, however, can be ſeen at once by the naked eye than about a thouſand, but by the help of teleſcopes millions have been diſcovered. The reaſon of their appearing ſo much more numerous is owing to their ſtrong ſparkling, and our looking at them through the atmoſphere.

Q. What is a planet?

A. A ſtar that has a periodical and regular motion: of theſe there are ſeven; their names are, reckoning them according to their nearneſs to the ſun, 1ſt, Mercury; 2d, Venus; 3d, the Earth; 4th, Mars; 5th, Jupiter; 6th, Saturn; and 7th, the Georgium Sidus, a modern diſcovery of Dr. Herſchell, in the year 1782. The earth has one moon to attend it; Jupiter four moons, Saturn ſeven, and the Georgium Sidus ſix moons.

Beſides theſe, four other very ſmall planetary bodies have been diſcovered in the courſe of the laſt ten or twelve years: theſe are named Ceres, Pallas, Veſta, and Juno.

Q. In what form or manner do theſe planets move?

A. Mercury may ſometimes, on account of his nearneſs to the ſun, though not frequently, be ſeen by the naked eye, in the ſplendour of whoſe beams he is generally abſorbed. The only way of obſerving him for any length of time is in his paſſage over the ſun, when he appears like a black ſpot on its ſurface. Venus is ſometimes our evening and ſometimes our morning ſtar. Mars and Saturn may eaſily be known, the former by its deep red colour, and the latter by its dull and leaden light. Jupiter is diſtinguiſhed from

the fixed ftars by the largenefs of his fize, and the brilliancy of his colour, which is fo great that it will fometimes illuminate a thin cloud in the fame manner as the moon. The Georgium Sidus, and the other planetary bodies, are not to be feen without a telefcope.

Q. Have all the planets moons attendant upon them as well as the earth?

A. No: fuch only of the planets as are fartheft from the fun, and therefore enjoy leaft of his light, have that deficiency made up by feveral moons, which conftantly accompany and revolve about them, as our moon revolves about the earth. The Georgium Sidus, the fartheft planet, has six moons, Saturn has feven, and Jupiter has four; thefe were difcovered by the telefcope, and cannot be feen without it. They are generally called fatellites, or fecondary planets.

Q. What is a comet?

A. A large body, with a long tranfparent tail, iffuing from that fide which is turned away from the fun; it moves in an orbit fo extremely eccentric, as fometimes to difappear for many, perhaps even for hundreds of years, and then appear again: the return of three only has been afcertained.

Q. When do thefe return?

A. One of them in 75 years, another in

129 years, and the third, or moſt remarkable, in 573 years. It appeared in 1680. When neareſt the ſun, Sir Iſaac Newton computed its heat to be 2000 times greater than that of red-hot iron.

The comets muſt be made of matter much harder and denſer than our earth, becauſe, in their approaches to the ſun they ſuſtain a degree of heat that would vitrify or even diſſipate any kinds of bodies that we know.

Q. Does the appearance of a comet foretel any great event?

A. No: it was formerly ſuppoſed that it did, but it was mere ſuperſtition.

Q. What is the earth?

A. The earth is the globe we inhabit.

Q. How large is it?

A. Its circumference is about twenty-five thouſand miles.

Q. What is its true figure?

A. Though we often call it a globe, yet it is by no means perfectly round, but widened out at the equator, and flattened at both poles, like an orange; this figure is called an oblate ſpheroid.

Q. Is it always fixed, or does it move?

A. It moves conſtantly round the ſun, and its motion is performed two ways: the earth turns round its own axis every twenty-four

hours, which alternately caufes day and night, as either fide is turned *toward*, or *from* the fun: it likewife revolves round that luminary in three hundred and fixty-five days, fix hours, which periodical revolution produces the feafons of the year. This double motion of the earth may be compared to coach-wheels, which go round their own axis at the fame time that they move on in their courfe. It travels at the rate of fifty-eight thoufand miles every hour, which is one hundred and twenty times fwifter than a cannon-ball; and by its rapid motion on its axis, the inhabitants of London are carried five hundred and eighty miles every hour. Thofe at the equator move much fafter; thofe towards the poles (if there be any) much flower; and thofe at the very poles move hardly at all.

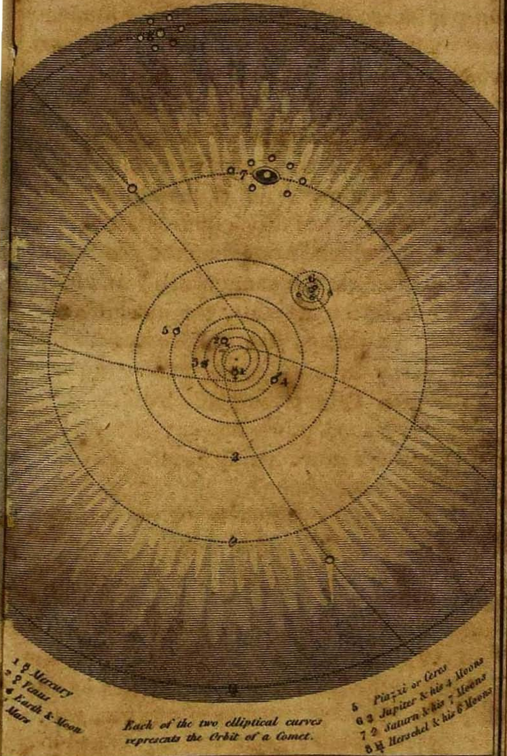
Q. What is an eclipfe?

A. An eclipfe is a total or partial privation of the light of the fun or moon. There are two forts of eclipfes; one of the fun, the other of the moon.

Q. When does an eclipfe of the fun happen?

A. When the moon comes between the fun and the earth. In this pofition fhe will wholly or partly intercept the rays of the fun, which is then faid to undergo an eclipfe. When this eclipfe is total, the darknefs is fo great that

THE SOLAR SYSTEM.



Each of the two elliptical curves represents the Orbit of a Comet.

R. Penny sculp.

the ſtars have been known to appear at noon-day.

Q. What is the cauſe of an eclipſe of the moon?

A. It is occaſioned by the earth coming between the moon and the ſun: it is eaſy to be conceived, that the moon, having no light of her own, when the rays of the ſun are intercepted from her, ſhe will appear dark or duſky.

An eclipſe of the *ſun* never happens but at a new moon, nor one of the *moon* but when ſhe is full.

LESSON XIII.

Of Geography.

Totam licet animis, tanquam oculis, luſtrare terram mariaque omnia.

"One may ſurvey the whole earth, and all the ſeas that ſurround it, in the mind, juſt as they are preſented to the eye." CICERO.

Q. WHAT is geography?

A. A deſcription of the earth: the earth is divided into four parts, commonly called quarters: 1ſt, Europe, which we inhabit; 2d, Aſia; 3d, Africa; 4th, America.

Q. By whom was the earth peopled?

A. By the children of Noah—*Shem*, *Ham*, and *Japhet.*

Q. Why is America often called the new world?

A. Becauſe it was not diſcovered till about three hundred years ago. It was diſcovered in 1493, by Chriſtopher Columbus, ſent out by Ferdinand King of Spain.

Q. Why then is it called America?

A. Becaufe a perfon named *Americus Vefpucius*, being fent after Columbus, difcovered a greater part of the Continent, and contrived to give his own name to the whole. The iflands near the continent are named the Weft Indies, to diftinguifh them from the Eaft Indies.

The reafon of their being fo called was this: when Columbus, who was in queft of a weftern paffage to the Indies, arrived at the firft land, which was the ifland of Hifpaniola, he really thought he had reached the Indies, and therefore gave it that name. But upon his error being difcovered, the term *Weft* was added to Indies, in order to diftinguifh thefe iflands from the real Indies, which lie in Afia, and are fo called, either from the Indus, one of the principal rivers of the country, or from the word Hindoos, the name of the original inhabitants.

Q. Which is the largeft of the four quarters of the world?

A. America, which has the moft mines of gold and filver: but Afia is the richeft in natural productions: it is this quarter that furnifhes us with fpices.

Q. And where is the heat of the fun moft intenfe?

A. In Africa, which produces negroes, a race of people quite black, having flat nofes, thick lips, and hair like wool: but that which is moft peopled, and where the fciences are moft cultivated, is Europe, though the fmalleft of the four.

Q. How are each of the parts of the world diftinguifhed?

A. From the time of Charles the Great they have been diftinguifhed by the names of eaft, weft, north, and fouth.

Q. How do we know where to find thofe parts?

A. By turning the back to the fun at noon; and on the right will be the eaft, on the left the weft, behind us the fouth, and directly oppofite will be the north.

Q. How are the winds that blow from thefe four quarters named?

A. They are called after the fame manner; 1ft, the eaft-wind; 2d, weft-wind; 3d, north-wind; and 4th, fouth-wind.

Q. What is the fea?

A. A fea is a large collection of falt water.

Q. Whence is it that the fea water is charged with faltnefs, while that of rivers is mild, frefh, fweet, and fit for human purpofes?

A. Some think it arifes from great beds of falt lying at the bottom of the fea. But

others ſuppoſe it was owing to the following cauſe: ſalt is one of the original principles of nature, and is mixed, in greater or leſs quantities, with moſt other bodies. Now all rivers run into the ſea, and carry ſome ſalt with them; but no rivers run out of it, nor is any water taken from it, except by exhalation or evaporation. But chemiſts have demonſtrably proved, that no ſalt can aſcend in either of theſe ways; and conſequently that all the ſalt that is carried into the ſea by the immenſe number of rivers that run into it, remains behind, and occaſions its ſaltneſs. That no ſalt aſcends from the ſea, either by exhalation or evaporation, is evident from this, that rain water, which falls from the clouds, and was originally extracted from the ſea, is, of all kinds of water, the ſweeteſt, pureſt, and lighteſt, and is made the ſtandard by which philoſophers judge of all other waters. See the Biſhop of Landaff's Chemical Eſſays, vol. ii.

Q. How are the ſeas diſtinguiſhed?

A. They are generally diſtinguiſhed by their ſituation. Thus we ſay the South Sea, the North Sea, the Britiſh Sea, and the Iriſh Sea, &c. The general term for a large extenſive ſea is an ocean; as the Atlantic Ocean between Europe and America, the Pacific

Ocean between America and Aſia, and the Indian Ocean between Africa and the Eaſt Indies.

Q. What is a ſtrait?

A. A narrow paſſage of water, incloſed by two ſhores, as the ſtrait of Dover between England and France, &c.

Q. What is a continent?

A. A large quantity of land, containing whole countries and kingdoms, that are not ſurrounded by the ſea; ſuch as Europe, Aſia, Africa, and America.

Q. What is a gulph?

A. A gulph is a part of the ſea that runs in between land; if it be very large, it is rather called an inland ſea.

Q. What is an iſthmus?

A. A narrow neck of land between two ſeas, joining a peninſula to the continent: as the Iſthmus of Darien, or Panama, which joins North to South America.

Q. What is a promontory?

A. A promontory is a high land that juts into the ſea: it is often called a cape, as the Cape of Good Hope in the ſouth of Africa.

Q. What is an iſland?

A. An iſland is a part of the earth that is ſurrounded by ſea or other water, as Great Britain, Ireland, Sicily, &c. There are alſo iſlands in rivers.

Q. What is a peninſula?

A. A part of land that is almoſt ſurrounded by the ſea; as the *Morea*, which joins to Greece.

Q. What is a lake?

A. A lake is a large extent of water ſurrounded with land, that never dries, and that has no current, as the Caſpian Lake in Aſia, moſt commonly, but improperly, called the Caſpian Sea.

Q. From whence do rivers and brooks derive their ſtores?

A. A river is a ſtream of freſh water, formed from one or many ſprings, which, running down the valleys between the ridges of the hills, and uniting, form little rivulets or brooks; many of theſe again meeting in one common valley, become a river, the magnitude of which is generally in proportion to the greatneſs of the mountains from whence its waters deſcend.

Q. What are fountains or ſprings?

A. Fountains or ſprings, are thoſe waters that iſſue from the ſides of hills and mountains, where they form natural pools or baſons, which overflowing, the waters deſcend in rivulets, and, as before obſerved, give riſe to rivers.

LESSON XIV.

Geography.

Q. HOW is the whole extent of land divided?

A. Into an indefinite number of countries or ſovereignties: in theſe are ſeven ſorts of governments in Europe, viz. Empires, Kingdoms, the Eccleſiaſtical State, Republics, Electorates, Dukedoms, and Principalities.

Q. How many empires are there?

A. *Three*; the empire of Germany, the Ottoman or Turkiſh empire, and the empire of Ruſſia.

Q. How was the empire of Germany formerly called?

A. The Roman empire; becauſe its head is a ſucceſſor of the ancient Roman emperors in the weſtern empire.

Q. What is remarkable of the Ottoman empire?

A. That the greateſt part of it is ſituated in Aſia, and its head is a ſucceſſor of the ancient Roman emperors in the eaſt.

Q. Why is this diſtinction made between the eaſtern and weſtern empires ?

A. When the Romans had conquered almoſt the whole earth, and formed the fourth monarchy, one of their emperors, Theodoſius the Great, ordered, that after his death the empire ſhould be parted between his two ſons, Arcadius and Honorius. The firſt had the eaſtern part of the empire, and continued his reſidence at Conſtantinople. The ſecond had the weſtern part. This event happened about the end of the fourth century.

Q. What have you to remark of the empire of Ruſſia ?

A. It is little more than eighty-eight years ſince this country was erected into an empire, viz. in 1727 ; ſince that time its princes have been ſucceſſively acknowledged emperors by the other European monarchs.

Q. What title had theſe princes before ?

A. They had, and ſtill keep, the name of *Tzar, or Czar,* which ſignifies Great Duke, or King.

Q. How many kingdoms are there in Europe ?

A. Several : Portugal, Spain, England, France, the two Sicilies, Sardinia, Sweden, Denmark, Pruſſia, Hungary, and Bohemia.

Q. What is the eccleſiaſtical ſtate ?

A. A part of Italy, under the dominion of the Pope. Lucca and Switzerland are the chief republics.

Q. How many electorates are there?

A. Nine; three ecclefiaftical, the archbifhopric of Mentz, of Treves, and of Cologne:—fix fecular, the kingdom of Bohemia, the dukedom of Bavaria, the dukedom of Saxony, the principality of the Palatinate, the marquifate of Brandenburgh, the electorate of Hanover. But in addition to thefe, three electorates have been created fince the French revolution, viz. Heffe Caffel, Baden, and Wirtemberg.

Q. Where are they fituated?

A. All in Germany, except the electorate of Bohemia, which is an independent kingdom.

Q. Are they all fovereign ftates?

A. Yes; but held by fief of the emperor and empire.

Q. How many dukedoms are there?

A. They are very numerous: Auftria is the only archdukedom. The principal dukedoms are Lorrain, Courland, Silefia, Milan, Savoy, Modena, &c. and in Germany thofe of Saxony, Mecklenburgh, Holftein, &c.

Q. What is a principality?

A. A principality, like a dukedom, is a

ſmall ſovereignty.—There are a great many of them, and they are generally dependant on ſome more conſiderable ſtate. In Germany there are two ſorts, one eccleſiaſtical, the other ſecular; the former are arch-biſhopricks, biſhopricks, or abbies; the latter are governed by mar-graves and land-graves.

Q. What more is to be remarked of Germany?

A. Two things; 1ſt, that it is divided into circles; and 2d, that there are in it a great number of free and imperial towns.

Q. What is a circle?

A. A certain extent of country.

Q. How are they called?

A. 1ſt, Auſtria; 2d, Suabia; 3d, Bavaria; 4th, Franconia; 5th, Upper Saxony; 6th, Lower Saxony; 7th, Weſtphalia; 8th, Lower Rhine; 9th, Upper Rhine; and 10th, Burgundy.

Q. What is a free and imperial town?

A. Free cities are little ſovereign ſtates, but have ſome dependance upon the emperor and empire. The principal were formerly Nuremberg, Augſburg, Ratiſbonne, Hamburgh, Franckfort, Cologne, &c.

Q. What are the principal cities of the three empires?

A. The capital of Germany is *Vienna*; of Turkey, *Conſtantinople*; of Ruſſia, *Peterſburg*.

Q. What are the capital cities of the ſeveral kingdoms?

A. The capital of the kingdom of Portugal is *Liſbon*; of Spain, *Madrid*; of England, *London*; of France, *Paris*; of the two Sicilies, *Naples*; of Sardinia, *Cagliari*; of Sweden, *Stockholm*; of Denmark, *Copenhagen*; of Pruſſia, *Konigſburg*; of Hungary, *Buda*; of Bohemia, *Prague*; of Etruria, *Florence*; and of Italy, *Milan.*

Q. What is the capital of the eccleſiaſtical ſtate?

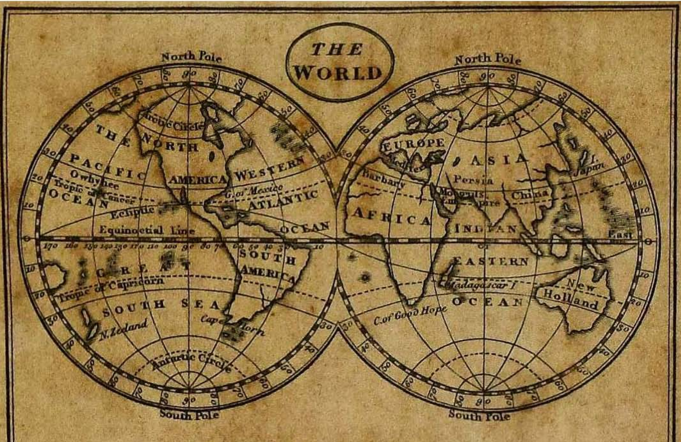
A. Rome, which was formerly the capital of the Roman empire. *Amſterdam* is the capital of Holland, and *Zurich* of Switzerland.

Q. What are the capitals of the electorates?

A. Mentz is the capital of the electorate of the ſame name; *Treves*, of the electorate of the ſame name; *Bonn*, of Cologne; *Prague*, of Bohemia; *Munich*, of Bavaria; *Dreſden*, of Saxony; *Manheim*, of the Palatinate; *Berlin*, of Brandenburgh; *Hanover*, of Hanover, or Brunſwick Lunenberg; *Caſſel*, of Heſſe Caſſel; *Baden*, of Baden; and *Stutgard*, of Wirtemberg.

Q. What are the principal rivers in Europe?

A. The *Dwina* and the *Tanais*, in Ruſſia;



Agreeable to the last Discoveries in the South Seas &c.

the *Danube*, the *Rhine*, and the *Elbe*, in Germany; the *Seine*, the *Rhone*, and the *Garonne*, in France; the *Maese*, in the Low Countries; the *Viſtula*, in Poland; the *Thames*, *Severn*, and *Humber*, in England; the *Tagus*, the *Ebro*, and *Douro*, in Spain and Portugal; and the *Po*, in Italy.

Q. What are the chief iſlands in Europe?

A. Great Britain and Ireland in the north; in the Mediterranean Sea are Minorca, Yvica, and Majorca, ſubject to Spain; and Malta, to England. Corſica was formerly ſubject to Genoa, but declared itſelf a free ſtate under the brave Paoli, who was afterwards driven out of his territories by the French, to whom the Genoeſe ſold the iſland. Paoli retired to England, where he lived peaceably for ſome years; the French revolution, however, enabled him to return to his native country, where he was ſtill conſidered as chief; and the Convention iſſuing ſome harſh decrees againſt the brave iſlanders, and ordering their beloved leader to be brought a priſoner to Paris, they reſolved to throw off the yoke: with the aid of the Engliſh, moſt of the iſland was recovered from the French, and the King of England was declared King of Corſica in a full aſſembly of the States. Sardinia is ſubject to its own king; and the iſlands of the

Archipelago, with Candia, own the Grand Turk for their maſter; the iſlands of the Baltic, the Adriatic and Ionian Seas, are not worth your notice.

Q. How is *Aſia* divided?

A. Into the kingdoms of Tartary, China, (from whence we have great quantities of china ware, raw ſilk, and tea,) India, Perſia, Indoſtan, and Turkey in Aſia.

Q. What are the principal iſlands in this quarter?

A. The iſlands in Aſia are the Marian, or Ladrone Iſlands, Formoſa, and the Phillippines, in the Eaſtern Ocean; the Moluccas, and the ſpice iſlands, Celebes, Borneo, Java, Sumatra, Ceylon, the Maldives, &c. in the Indian Ocean; Cyprus, Rhodes, Leſbos, or Mytilene, Chios, or Scio, Samos, Coos, and a multitude of others of leſs notice.

Q. What is this quarter moſt famous for?

A. Its having been the reſidence of our firſt parents, and having given birth to our bleſſed Saviour.

Q. What are the manners of its inhabitants?

A. In general they are groſs, ignorant, and lazy. They are devoted to pleaſure, are extremely jealous of their wives, and cruel to their ſlaves.

Q. What are the chief kingdoms of Africa?

A. Egypt, Barbary, Morocco, Zaara, or the Great Defert, Negroland, Ethiopia, and Guinea, where fhips formerly went yearly to purchafe flaves.

Q. Are the iflands of Africa confiderable?

A. Yes; but the following are the principal ones: Madagafcar the largeft, called alfo St. Lawrence, the inhabitants are black, wild, favage, naked, and under no particular governor; the fmall iflands of Cape Verd, the Canary iflands, the Madeiras, noted for excellent wines, the Guinea ifles, and the ifles of Afcenfion and St. Helena, with others of leffer note in the Ethiopic fea.

Q. What character have the people?

A. The inhabitants are for the moft part tawny, and in fome parts quite black; they have always been grofs idolaters, worfhipping the ftars, fire, and planets.

Q. What are the divifions of N. America?

A. The chief kingdoms, ftates, and colonies in North America are, Old Mexico, or New Spain, New Mexico, or Granada, and Florida, belonging to Spain. New Scotland, New Britain, or Efquimaux, and Canada, to the Englifh. New Hampfhire, Maffachufet's Bay, Rhode Ifland, Connecticut, New York, New Jerfey, Pennfylvania, Delaware, Maryland, Virginia, North Carolina, South Caro-

lina, and Georgia, compoſe the United States; to which may now be added the infant ſtates of Vermont and Kentucky.

Q. What are the iſlands of North America?

A. The iſlands belonging to Great Britain are, Newfoundland, Jamaica, Martinique, Trinidad, Tobago, St. Chriſtopher's, vulgarly called St. Kitt's, Antigua, Dominica, Barbadoes, the Grenades, Barbuda, Nevis, Montſerrat, and St. Vincent's; except Newfoundland, Jamaica, Trinidad, and Tobago, theſe iſlands are diſtinguiſhed by the general name of the Caribbee Iſles.

The iſlands belonging to Spain are Cuba, Porto Rico, the Virgin Iſles, and Margaretta. In the weſt part of St. Domingo, a general inſurrection of the negroes took place in the revolutionary days of France, the whites were exterminated, and a black empire is now eſtabliſhed.

Q. How is South America divided?

A. Into Terra Firma, Peru, belonging to the Spaniards, the country of the Amazons, but little known, the Brazils, belonging to the Portugueſe, Chili, and Patagonia, lately diſcovered.

Q. What elſe have you to remark of America?

A. That its mountains are much higher,

and its rivers much larger than thoſe of the old world. The height of the Pyrenees between France and Spain is not ſeven thouſand feet. The height of the mountain Gemmi (the higheſt point of the Alps in Switzerland), is but ten thouſand feet. The height of the Peak of Teneriffe, in the Atlantic Ocean, is about thirteen thouſand feet. But the height of Chimborazo, the moſt elevated point of the Andes, is about twenty thouſand feet, that is, almoſt four miles.

Q. Are not the tops of theſe lofty mountains covered with perpetual ſnow?

A. They are; which is owing partly to their great height, and partly to the uncultivated nature of the country around them.

Q. How does their great height contribute to this?

A. By placing them out of the reach of the reflected rays of the ſun: for it is well known that the heat of a climate, or of the weather, depends much more upon the reflected than the direct rays of the ſun.

Q. How does the uncultivated face of the country help to produce this effect?

A. By the very ſame means which we have now mentioned. An uncultivated country is ſo far from reflecting the rays of the ſun, that it totally ſwallows them up by its woods,

foreſts, and moraſſes: and this, probably, is the reaſon why America is ſo much colder than Europe. In America it is as cold in 40 degrees of latitude as it is in Europe in the latitude of 50, or even 55.

But in proportion as America comes to be cleared and cultivated, this difference will gradually decreaſe, till at laſt it may be totally aboliſhed.

Q. How much broader are the rivers of America than thoſe of Europe?

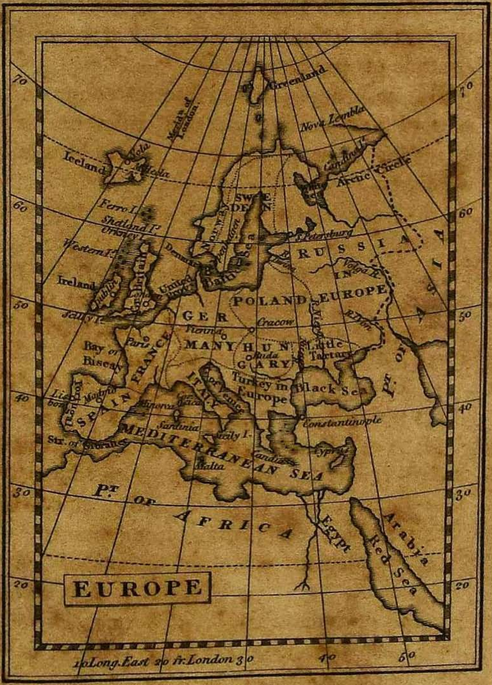
A. The largeſt rivers in Europe are not above a few miles in breadth. Some of the rivers in South America, and particularly the river La Plata, are 150 miles broad.

Q. Is not America as remarkable for its lakes as for its mountains and rivers?

A. Yes; the five great lakes at the head of the river St. Lawrence are more like petty ſeas than lakes. Lake Superior, eſpecially, is ſaid to be 1500 miles in circumference.

Q. Which are the chief iſlands of South America?

A. Terra del Fuego, of which we have very little knowledge; Chiloe, near the coaſt of Chili, on which the Spaniards have a town named Caſtro; Juan Fernandez, off the coaſt of Chili, a pleaſant fruitful iſland; and the


EUROPE
Greenland
Nova Zembla
Meridian of London
Iceland
Arctic Circle
SWEDEN
NORWAY
Ferro I.
Shatland I.
Orkney I.
Western I.
Denmark
Baltic Sea
St. Petersburg
RUSSIA IN EUROPE
Volga R.
Ireland
Dublin
United Provinces
POLAND
Cracow
GERMANY
Vienna
HUNGARY
Buda
Little Tartary
Scilly I.
Paris
FRANCE
Bay of Biscay
Lisbon
Madrid
SPAIN
Minorca
Corsica
Sardinia
ITALY
Gulf of Venice
Sicily I.
Malta
Turkey in Europe
Black Sea
Constantinople
Candia
Cyprus
MEDITERRANEAN SEA
Str. of Gibraltar
Pt. OF AFRICA
Egypt
Arabia
Red Sea
Pt. of ASIA
10 Long. East 20 fr. London 30
40
60
70
60
50
40
30
20

Gallipagos, a clufter of iflands lying under the equator, off the coaft of Peru.

Q. What is the general character of the natives of America?

A. They are generally of a brown complexion; the few that are white ftain themfelves of a red, or copper colour, and fome with ftreaks of blue. They are fond of adorning themfelves with ftrings of beads and fhells about their necks, and rings in their ears and nofes. They fcalp their prifoners, and fometimes, it is faid, broil and eat them.

LESSON XV.

Of Hiſtory.

Q. WHAT is hiſtory?

A. Hiſtory is an account or relation of any thing that has been done.

Q. How is hiſtory divided?

A. Into ſacred and prophane, ancient and modern?

Q. What is ſacred hiſtory?

A. Sacred hiſtory is the hiſtory of the church of God, under the Old and New Teſtament. The Old Teſtament contains the hiſtory of the Jews, or Hebrews, or thoſe who are called the people of God. The New Teſtament contains the hiſtory of Jeſus Chriſt, the Son of God, and his diſciples, who called themſelves after his name, Chriſtians.

Q. What is prophane hiſtory?

A. Prophane hiſtory is an account of the heathen gods, demi-gods, and heroes.

Q. What is ancient hiſtory?

A. Ancient hiſtory is an account of all the empires, kingdoms, republics, and ſtates, from the creation of the world to the birth of Chriſt.

Q. What is modern hiſtory?

A. An account of thoſe empires, kingdoms, &c. from the birth of Chriſt to the preſent time.

Q. Have not the poets made another diviſion of hiſtory?

A. Yes; they diſtinguiſhed firſt the golden age, which they attributed to Saturn and Rhea, meaning by it the more perfect and happy ſtate of men in the firſt ages of the world.

2d, The ſecond is the ſilver age, aſcribed to the reign of Jupiter, and which extended to the time that tyrants appeared among the human race, who, to render themſelves powerful, oppreſſed mankind by violence and injuſtice.

3d, The third was the brazen age, which was, when rapacious men, poſſeſſed with the luſt of dominion, endeavoured to reduce their brethren to a ſtate of ſlavery.

4th, The fourth age is that of iron, when all ſorts of crimes began.

Q. What is the earlieſt hiſtory we have?

A. That of the creation of the world, the fall of man, the univerſal deluge or flood, the preſervation of the human race in the family of Noah, and the re-peopling the ſeveral nations by his three ſons, and their poſterity.

Q. How may we divide ancient hiſtory ſo as to have the cleareſt idea of it.

A. Into the four remarkable periods or æras of the four ſucceſſive monarchies, called univerſal: they are called univerſal, becauſe each of them extended over the greateſt part of the then known world.

Q. What was the firſt of theſe univerſal monarchies?

A. The *Aſſyrian Empire*, founded by Nimrod, the ſon of Cuſh, and grandſon of Ham, in the year of the world 1800; it was continued by his ſon Ninus, and after him by his wife Semiramis, the moſt celebrated heroine of ancient hiſtory, and ended under Sardanapalus in 3250, enduring 1450 years.

Q. What was the ſecond monarchy?

A. The *Perſian.* It began with their king, Cyrus, in the year of the world 3468, and ended with Darius's being conquered by Alexander the Great, 3670, before Chriſt 330, laſting a little more than 200 years.

Q. By whom was the third monarchy eſtabliſhed?

A. The *Grecian*, which was the third univerſal monarchy, was eſtabliſhed by Alexander the Great, king of Macedonia, in the year of the world 3670, and laſted no longer than his life; for, at his death, as there was

no proper ſucceſſor left, his generals divided the empire amongſt them.

Q. Why was Alexander called the Great?

A. Both on account of his natural valour, and alſo the ſucceſs of his arms; for in twelve years he ſubdued all the nations from the Adriatic Sea to the river Ganges, in India.

Q. What was the fourth monarchy?

A. The *Roman empire*, founded by Romulus, which at laſt aroſe, and became, under Auguſtus Cæſar, miſtreſs of the whole earth, except China, and thoſe countries that were either unknown, or inhabited by ſavage nations, or too inconſiderable to attract regard, and continued, under twelve Cæſars, to the year of Chriſt 96.

Q. Did not the Roman government undergo many changes?

A. Yes; the firſt ſtate of Rome was regal, under twelve kings; the ſecond was conſular, under a ſeries of conſuls, for the ſpace of four hundred and ſeventy years. After this, the triumvirate was formed between Julius Cæſar, Pompey, and Craſſus: but Cæſar, aſpiring to univerſal dominion and ſovereignty, after a long war with Pompey, whom he defeated, gained to himſelf not only the empire of the Romans, but, in a few years, that of all the known world beſides.

Q. How many forms of government are there?

A. Three; the monarchical, the ariſtocratical, and the democratical.

Q. What is the monarchical government?

A. When the ſupreme authority is in the hands of one perſon. If he be a good prince, he is called a king; if a bad and unjuſt one, he is called a tyrant.

Q. Have thoſe perſons who have the government in their own hands all the ſame degree of power?

A. No; ſome are deſpotic, that is, act as they pleaſe; they are abſolute maſters of the lives and fortunes of their ſubjects, and have no other rule for their conduct but their own will: while the authority of others is reſtrained by the laws.

Q. What is the ariſtocratic government?

A. When the ſovereign authority is lodged in the hands of a few of the principal perſons of the ſtate.

Q. What is the democratical government?

A. When a number of perſons deputed by a nation exerciſe the ſovereign authority.

Q. What is the beſt form of government?

A. This queſtion is not yet decided; but we may venture to ſay, that the monarchical government would be the beſt, were the monarchs always ſuch as they ought to be.

Q. To what form of government do we generally give the preference?

A. To the republican; becaufe it agrees beft with our notions of liberty. It is well adapted for improving all the powers and faculties of the human mind. The Greeks and Romans, who enjoyed a republican government, made fuch furprifing advances in the arts and fciences, that they left all the other nations of antiquity infinitely behind them. They are, indeed, the only ancient nations whofe hiftory is much worth ftudying.

Q. What is the eftablifhed government in England?

A. Limited monarchy, hereditary, and females are capable of fucceffion. The title of his prefent Majefty is King of the United Kingdom of Great Britain and Ireland, Defender of the Faith: and he is head of the church. His foreign titles are, Duke of Brunfwick-Lunenberg, Arch-Treafurer and Elector of the Holy Roman Empire. The heir apparent has the title of Prince of Wales by creation*; he is born Prince of Scotland, Duke of Cornwall, and Earl of Chefter.

* In consequence of the lamented illness of our beloved sovereign, George III. his eldest son, the Prince of Wales and heir apparent to the throne of England, has been appointed, by an act of Parliament, Regent of the united kingdoms of England, Scotland, and Ireland, with sovereign authority to do all legal acts for the benefit and good government of the nation, in the name and on behalf of his Majesty.

Q. How was England anciently governed?

A. England was firſt under the *Britons*; 2dly, made tributary to the *Romans* by Julius Cæſar; 3dly, under the *Saxons*; 4thly, under the *Danes*; and 5thly, under the *Normans*; whoſe conqueſt of this iſland by their Duke, William, is the grand period from whence our hiſtorians begin to reckon.

Q. Name the ſucceſſion of our Engliſh monarchs from the conqueſt, with their ſeveral families.

A. 1ſt, Four Norman Kings.—1ſt, William Duke of Normandy; 2d, William Rufus; 3d, Henry I.; 4th, Stephen.

2d, Fourteen kings of the family of Plantagenet, who governed 331 years.—1ſt, Henry II.; 2d, Richard I.; 3d, John; 4th, Henry III.; 5th, Edward I.; 6th, Edward II.; 7th, Edward III.; 8th, Richard II.; 9th, Henry IV.; 10th, Henry V.; 11th, Henry VI.; 12th, Edward IV.; 13th, Edward V.; 14th, Richard III.

3dly, Five ſovereigns of the houſe of Tudor, who ſat upon the throne 118 years. 1ſt, Henry VII.; 2d, Henry VIII.; 3d, Edward VI.; 4th, Mary; 5th, Elizabeth.

4th, Six monarchs of the houſe of Stuart. 1ſt, James I.; 2d, Charles I.; 3d, Charles II.; 4th, James II.; 5th, Mary II. Queen of William III.; 6th, Anne.

5th, One king of the houſe of Naſſau—William III.

6th, Three kings of the Brunſwick line, which acceded upon the death of Anne.—1ſt, George I.; 2d, George II.; 3d, George III.

Q. What families have ſucceeded to the crown of France?

A. After the declenſion of the Roman empire, the Franks broke in upon the Gauls, and conquered the kingdom; their firſt king was *Pharamond*, A. D. 751. Of this family were twenty-one kings.—The ſecond race began under *Pepin*, A.D. 751. This line was followed by the Capetian race, ſo called from Hugh Capet, A. D. 988.—This family was ſucceeded by the houſe of *Valois*, in the perſon of Philip VI. A. D. 1328.—Upon the extinction of this family, the ſucceſſion fell on that of Bourbon, A. D. 1589, which continued till 1792, when the monarchy was deſtroyed by the ignominious death of Louis XVI. A republic was at firſt eſtabliſhed: this at length gave way to the ambition of Bonaparte, who, from the ruins of the republic, erected a powerful empire.*

* He exercised the sovereign authority with various successes, till, in the year 1812, his grand army was frozen and captured in Russia. Louis XVIII. the next brother of the unfortunate Louis XVI. then succeeded to the throne of his ancestors, and he (Bonaparte) was compelled, in April 1814, to retire to the island of Elba, under a treaty made at Fontainbleau. In this island his ambitious and tur-

Q. What race of kings have ſucceeded to the Spaniſh crown?

A. Since the expulſion of the Romans, Spain has been governed by five families: the firſt, from the Goths; the ſecond, after the invaſion of the Moors of Africa, from *Don Pelago*; the third from *Don Sancho*, king of Navarre; the fourth from the houſe of Auſtria, by the marriage of *Joanna*, daughter and heireſs of Ferdinand, ſurnamed the *Catholic*, to Philip, arch-duke of Auſtria, eldeſt ſon of the emperor Maximilian; and the fifth from the houſe of Bourbon, in Philip, duke of Angou, ſecond ſon of the dauphin of France, and grandſon to Louis XIV. whoſe deſcendants now wear the Spaniſh diadem.

Q. Of what family is the Emperor of Germany?

bulent disposition would not suffer him to remain in peace, and, by various intrigues and stratagems, assisted by the treachery of some persons who were permitted to remain in official situations in the French Government, he sailed from Elba on the first of March 1815, and arrived at Paris March 20, when he re-assumed the sovereign authority, Louis XVIII. retiring for a short period from France. On the 25th of April, 1815, the Sovereigns of Europe, assembled at Vienna, declared Bonaparte an outlaw; and on the 18th of June in the same year, a great battle was fought at Waterloo, where Bonaparte was completely defeated by the Duke of Wellington. He again abdicated the throne on the 21st of June, and, after various ineffectual struggles to rally his scattered fortunes, he surrendered to an English ship of war, off Rochefort: he was conducted to the shores of England, but not permitted to land; and on the 7th of August he was conveyed to the island of St. Helena, where he arrived October 18, 1815; and it may be fairly hoped, he will no more be able to disturb the tranquillity of Europe. Louis XVIII. is now on the throne of France, and it has been found necessary to suffer the law to be executed on Marshal Ney, and a few others of subordinate rank, who have been legally convicted of the most gross treachery to their sovereign.

A. He is deſcended from Rodolph I. Count of Hapſburg and Landgrave of Alſace, who was the firſt of his family that obtained the empire. He was elected A. D. 1723.

Q. Of what family is the Emperor of Turkey?

A. Of the Ottoman family, ſo called from the warlike Sultan *Othman* or *Oſman*, who, A. D. 1300, carried his conqueſts to a prodigious extent.

Q. From what family are the Kings of Portugal deſcended?

A. Portugal became a kingdom about the middle of the twelfth century. Count *Henry* receiving ſome territories bordering upon it from *Alonzo*, king of Leon, as a marriage dowry with his daughter, he expelled the Saracens, and his ſon *Alonzo* conquered Liſbon, and aſſumed the title of King of Portugal in 1146. In 1580 Philip II. of Spain ſeized upon this country; but in 1640 the Duke of Braganza recovered it, and in his family it has ever ſince remained independent of Spain.

A. How is Holland governed?

Q. It was formerly governed by a ſtadtholder, or captain general, which office was hereditary in the Prince of Orange's family; it was afterwards called a republic, then a kingdom, at the head of which was Louis

Bonaparte: this king has abdicated his throne, and Holland is now united to France.

Q. How is the prefent government of Italy divided?

A. It is divided into little republics, principalities, and dukedoms, which, in fpiritual matters, are fubject to the Pope, who, like the ghoft of the deceafed Roman empire, fits crowned upon its grave.

Q. Who is the prefent Pope, and what is his character?

A. Gregorio Barnaba Chiaramonti, born Auguft 11, 1742, at Caezena, in the Ecclefiaftical States, entered the order of the Benedictines at 16 years of age, was elevated to the dignity of a Cardinal by the late Pope Pius VI. and, on the death of that Pontiff (a captive in France), was elected Pope, in a conclave held at Venice, on the 13th of March, 1800, when he affumed the title of Pius VII. Rome was then poffeffed by the Neapolitan troops: but this effort to reftore an head to the Church was zealoufly feconded by the feveral Catholic Princes; and the new Pontiff, after vifiting the Emperor at Vienna, entered Rome, and took poffeffion of the Holy See, with the confent and approbation of the King of Naples, on the 3d of July following.

LESSON XVI.

Mythology.

" Mythology is the bafis of hiftory, the ftandard of
" criticifm, and the guide to the ftudies of youth."

BRYANT.

" *Ne ea quidem quæ funt a clarioribus poetis ficta negli-*
" *gere.*"

" We muft not overlook even the fictions of the more
" illuftrious poets." QUINTILLIAN.

Q. WHAT is mythology?

A. The religion of the Pagans,* which confifts in the worfhip of falfe gods, whom their poets, painters, and ftatuaries imagined, and to whom they gave different attributes.

* Men of a phlegmatic difpofition, or of a cenforious temper, never ceafe to rail againft the delightful fictions with which Homer and Hefiod, and their poetical imitators, have enriched and embellifhed their works: but although thefe fictions did not contain many ufeful inftructions, and important truths, would there be any reafon to attack and deftroy a fyftem which peoples and animates nature, and which makes a folemn temple

Q. Who was the oldeſt of the gods?

A. Time, called alſo Saturn, who is ſaid to have devoured his children as ſoon as they were born, becauſe it was decreed that one of them ſhould uſurp his dominions.

of the vaſt univerſe? Theſe flowers, whoſe varied and ſhining beauty you ſo much admire, are the tears of Aurora. It is the breath of Zephyrus which gently agitates the leaves. The ſoft murmurs of the waters are the ſighs of the Naïades. A god impels the wind; a god pours out the rivers; grapes are the gift of Bacchus; Ceres preſides over the harveſt; orchards are the care of Pomona. Does a ſhepherd ſound his reed on the ſummit

Q. Did not any of his children eſcape ?

A. Yes ; Jupiter, Neptune, Pluto, Juno, and Ceres, were ſaved by the fictions of his wife Rhea.

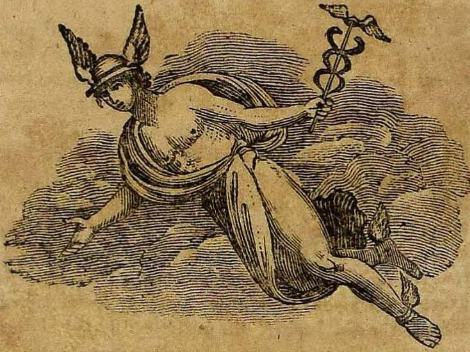
Q. What is meant by Saturn's devouring his children ?

of a mountain, it is Pan, who, with his paſtoral pipe, returns the amorous lay. When the ſportſman's horn rouſes the attentive ear, it is Diana, armed with her bow and quiver, and more nimble than the ſtag that ſhe purſues, who takes the diverſion of the chace. The ſun is a god, who, riding on a car of fire, diffuſes his light through the world ; the ſtars are ſo many divinities, who meaſure with their golden beams the regular progreſs of fire ; the moon preſides over the ſilence of the night, and conſoles the world for the abſence of her brother. Neptune reigns in the ſea, ſurrounded by the Nereides, who dance to the joyous ſhells of the Tritons. In the higheſt heaven it ſeated Jupiter, the maſter and father of men and gods. Under his feet roll the thunders, forged by the Cyclops in the caverns of Ætna ; his ſmile rejoices nature ; and his nod ſhakes the foundation of Olympus. Surrounding the throne of their Sovereign, the other divinities quaff nectar from a cup preſented them by the young and beautiful Hebe. In the middle of the great circle ſhines, with diſtinguiſhed luſtre, the unrivalled beauty of Venus, alone adorned with a ſplendid girdle, in which the Graces and Sports for ever play ; and in her hand is a ſmiling boy, whoſe power is univerſally acknowledged by heaven and earth. Sweet illuſions of the fancy ! pleaſing errors of the mind ! what objects of

A. Only that time deſtroys all things.

Q. How was the ſovereign authority divided between the three ſons of Saturn?

A. Jupiter, as the eldeſt, had the heavens, Neptune the waters, and Pluto the infernal regions.



Q. Who is the meſſenger of the gods?

A. Mercury, ſon of Jupiter and Maia, god of eloquence, and patron of commerce: he had wings on his feet, and a caduceus or wand, with two ſerpents about it, in his hand; and

pity thoſe cold and inſenſible hearts, who have never felt your charms! And what objects of indignation thoſe fierce and ſavage ſpirits, who would deſtroy a world that

uſhered ſouls into hell, or the Elyſian fields.

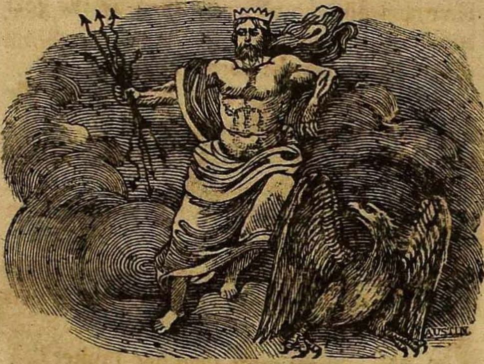
Q. Who was Hebe?

A. The goddeſs of youth, daughter of Jupiter and Juno, and cup-bearer of Jupiter, becauſe ſhe poured out the nectar, the drink of the gods: their food was called ambroſia.

Q. Who was Cybele?

A. The wife of Saturn, called Rhea, and mother of all the gods. She was uſually ſuppoſed to preſide over the earth, and has therefore generally a crown of turrets on her head.

has ſo long been the treaſury of the arts! a world imaginary indeed, but delightful, and whoſe ideal pleaſures are ſo well fitted to compenſate for the real troubles and miſeries of the world in which we live.



Jupiter.

Q. Who was this Jupiter?

A. The pagans called him the father of gods and men: he was the ſon of Saturn and Rhea.

Q. Had he always the name of Jupiter?

A. No; his firſt name was JOVIS, from which, by the addition of PATER, was formed *Jupiter*.

Q. How was he brought up?

A. The noiſe made by the muſical inſtruments of the Corybantes prevented his childiſh cries from diſcovering him to his father Saturn, whilſt he was nouriſhed by the goat Amalthea.

Q. Where was he born?

A. Some ſay in Arcadia, others in the iſle of Crete; ſome indeed give that honour to the city of *Thebes*, in Bœotia, whilſt others fix it at *Meſſenia*, in Peloponneſus.

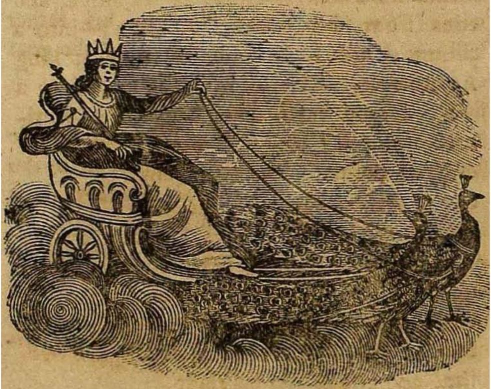
Q. What was his firſt action when grown up?

A. He depoſed and baniſhed his father Saturn, who had attempted to take away his life.

Q. Were there more than one Jupiter?

A. Yes; almoſt every nation had its Jupiter: thus there was Jupiter Ammon of the Lybians; Jupiter Serapis worſhipped in Egypt; and Jupiter Belus of the Aſſyrians, &c.

Q. Who was Jupiter's wife?



A. Juno, his own ſiſter.

Q. What is ſaid of her?

A. The ancients conſidered her as a goddeſs of kingdoms, queen of the gods and riches, daughter of Saturn and Rhea, ſiſter and wife of Jupiter, who, by the continual jealouſy between them, rendered themſelves a very unhappy couple.

Q. Where was ſhe born?

A. Some ſay at Argos, a town of Greece, others at Samos.

Q. Did not Jupiter often transform himſelf to ſucceed in his amours?

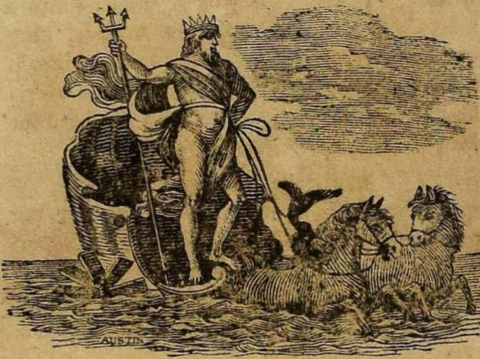
A. Yes. He metamorphoſed himſelf into a ſwan for Leda, daughter of Theſtius, and wife of Tyndarus, king of Laconia;—into a bull for Europa, daughter of Agenos, king of Phœnicia, and ſiſter of Cadmus;—into a ſhower of gold for Danäe, daughter of Acriſius, king of Argos;—and into a ſhepherd for Mnemoſyne, the goddeſs of memory.

Q. Did he always reign in peace?

A. No. His throne was ſhaken by the earth-born giants, called Titans, among whom was one, who, from an hundred hands at once, diſcharged an hundred mountains at the heavens. Jupiter, however, triumphed over them, and eſtabliſhed his reign.

Q. What children had he by his different miſtreſſes?

A. By *Leda* he had *Caſtor* and *Pollux*, brothers of *Helena* and *Clytemneſtra*; they followed Jaſon in his expedition to Colchis for the golden fleece, and conceived ſo great a friendſhip for him, that they never left him: by *Europa* he had *Minos* and *Rhadamanthus*, who, from their ſeverity in diſpenſing juſtice while on earth, were named judges of hell: by *Danäe* he had *Perſeus*, who rendered his name famous; he had alſo a friendſhip for men of letters, and founded a ſchool: and by *Mnemoſyne*, the goddeſs of memory, he had the *nine Muſes*.



Neptune.

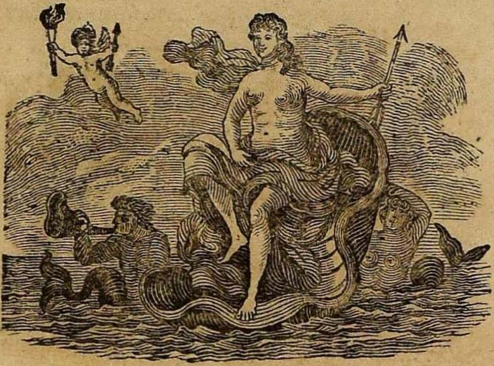
Q. What is related of this god?

A. That he had the ſovereignty of the ſeas; he was the ſon of *Saturn* and *Rhea*, and brother of *Jupiter* and *Juno*.

Q. What became of him after his birth?

A. It is ſaid that his mother concealed him, as ſoon as he was born, from the devouring jaws of *Saturn*, and ſubſtituted in his place a young foal, of which ſhe pretended to have been delivered.

Q. Whom did he marry?



A. *Amphitrite*, daughter of *Oceanus* and *Doris*, mother of the *Nereides*.

Q. What is the ſignification of the word *Neptune?*

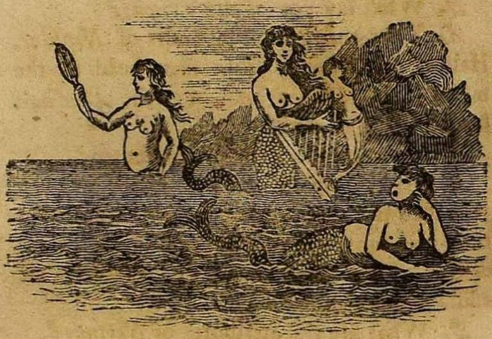
A. It ſignifies in Greek "god of the waters."

Q. Who were the children of *Neptune?*

A. *Polyphemus*, *Phorcus*, *Proteus*, and *Triton*.

Q. Who were *Neptune's* attendants?

A. The *Syrens*, the *Naiades*, and the *Tritons*.



Q. Who were the *Syrens?*

A. They were beings repreſented under the figure of a beautiful virgin, from the head to the middle, and from thence downwards by that of a fiſh, covered with ſcales. They are ſaid to inhabit the ſteep rocks upon the ſea ſhore, where, having allured paſſengers by the ſweetneſs of their muſic, they put them to death.

Q. And the *Naiades*, who are they?

A. They are the ſame as the *Syrens*, half women and half fiſh, and compoſed the train of *Amphitrite.* They reſided, as ſo many

domeſtics, in the palaces of the water gods; where they are ſaid to work, and tell ſtories, and then to come and wait at table.

Q. What ſay you of the *Tritons?*

A. That they made the court of *Neptune.* Half of their body, from their head to the middle, reſembled a man, and the other half had the form of a fiſh.

Q. How are the *Tritons* repreſented?

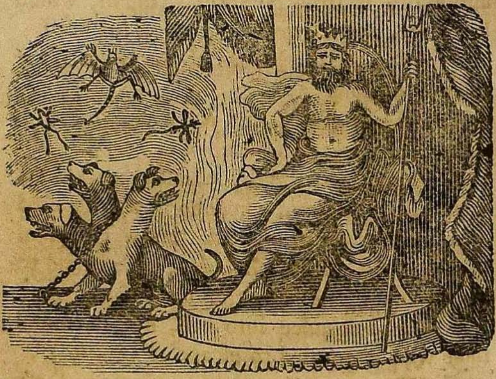
A. As ſitting upon a dolphin, with a wreathed trumpet in their mouth, with which they are ſuppoſed to convene all the water deities, when their monarch wanted their aſſiſtance or counſel.

Q. What are the attributes of *Neptune?*

A. He is repreſented ſitting upon a pearl ſhell, drawn by two ſea-horſes, having a trident in his right hand, uſed by him chiefly to agitate the waves; but he ſometimes laid it aſide when he was to appeaſe them, though he reſumed it on occaſion.

Q. Where does he reſide?

A. In a palace of chryſtal, at the bottom of the ſea.



Pluto.

Q. Who was god of the infernal regions?

A. Pluto, ſon of *Saturn* and *Rhea*, to whom *Jupiter*, after deſtroying his father, gave the infernal regions as his part of the empire.— This god was ſo extremely black and ugly, that he could not find any woman inclined to partake of his throne, which determined him to carry away *Proſerpine*, daughter of *Ceres*, whilſt ſhe amuſed herſelf with her nymphs in gathering flowers. He is repreſented upon a chariot drawn by four black horſes.

Q. What are his attributes?

A. A ſceptre, or batoon of two points, to diſtinguiſh it from Neptune's trident, which had three, and a crown of iron on his head.

Q. Who are the judges of the dead in the infernal regions?

A. *Minos*, *Æacus*, and *Rhadamanthus.*

Q. Who was the porter of hell?

A. It was guarded by a vaſt three-headed dog, called *Cerberus*, whoſe body was covered with ſnakes inſtead of hair. He was born of the giant *Typhon* and *Echidna.* He is ſaid to have given a kind reception to thoſe unhappy ſouls who deſcended into hell, but devoured thoſe who attempted to eſcape.

Q. What are the principal rivers in theſe dark realms?

A. 1. *Acheron*, whoſe waters are extremely bitter. 2. *Styx*, by which the gods were uſed to ſwear. 3. *Cocytus*, flowing out of *Styx*, with a horrible groaning noiſe, and encreaſes with the tears of the wicked. 4. *Phlegethon*, ſwelling with waves of fire. Over theſe four rivers the ſouls were ferried by Charon, to Tartarus, or Hades, the heathen hell.

Q. Deſcribe to me Tartarus.

A. TARTARUS, or the REGION of TORMENTS, is an hideous priſon of a terrible

depth, ſurrounded by the miry bogs of Cocytus, and the river Phlegethon, which rolls torrents of flames all round; three rows of walls, with brazen gates, render the place inacceſſible. Here the wicked ſuffer a puniſhment proportioned to their crimes.*

Q. Where did they ſuppoſe the ſouls of the virtuous were conveyed after their death?

A. Into Paradiſe, which they call the ELYSIAN FIELDS, or the REGIONS of BLISS. It conſiſted of pleaſant plains, verdant fields, ſhady groves, purling ſtreams, and the moſt ſerene and temperate air. After the happy

* The moſt impious of the condemned in hell are the REBEL GIANTS, who, after their defeat by Jupiter, were caſt down to Tartarus, to receive the puniſhment due to their enormous crimes. The poets, in ſpeaking of theſe monſters, ſay that they had ſnakes inſtead of legs. TANTALUS is repreſented as hanging over the waters, which are always flowing through his hand, and gliding from him: to this eternal torment of hunger and thirſt he was condemned, for having invited the gods to a feaſt, when, to prove their divinity, he killed, boiled, and ſerved up the joints of his ſon Pelops on the table before them to eat. SISYPHUS, a notorious robber, is condemned to roll a vaſt ſtone up to the top of a hill, which ever ſlides down again, and makes his labour perpetual. IXION, condemned for impiety and ingratitude, in attempting to violate the chaſtity of Juno, is fixed to a wheel, which hurries him round in one perpetual whirl.

fouls had long enjoyed this Elyfium, they drank of the river Lethe, which made them forget all thofe pleafures, and then returned to the earth again, and poffeffed new bodies, in order to fill up the courfe of their probation in our world.

Q. What other deities do we meet with in the infernal regions?

A. Old *Erebus* and his wife *Nox*, who prefide over darknefs and night. Alfo *Mors* over death, and *Somnus* over fleep, who, by his fervant *Morpheus*, fends dreams to us above while fleeping. The attendants upon *Somnus* are Reft, Eafe, Indolence, Silence, and Oblivion.

Q. What was the doctrine of tranfmigration?

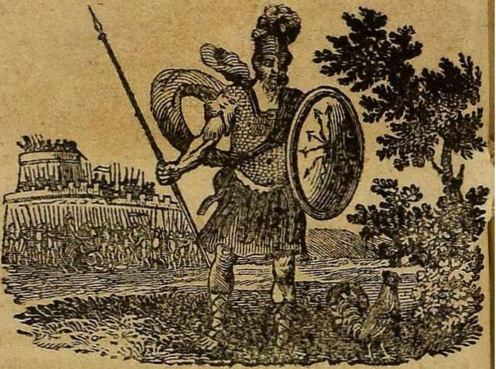
A. When the fouls left the bodies which they animated, they were conducted by Mercury, either to the Elyfian Fields or Tartarus, according as they were or were not virtuous.

LESSON XVII.

1. *Sequel of Mythology.*

" A knowledge of feigned Hiſtory, or Mythology, is abſolutely neceſſary to the Reader of the Claſſics," &c.

KNOX.



Q. WHO is *Mars?*

A. Mars was the ſon of *Jupiter* and *Juno*; he was the god of armies and war, and is repreſented armed cap-a-pee, with a cock at his feet, becauſe he metamorphoſed into a cock his favourite *Alectryon*, who, keeping watch whilſt he was with Venus, ſuffered him to be ſurpriſed.

Q. Who was the goddeſs of war?

A. Bellona, ſiſter of *Mars*, who generally conducts his car armed with a whip, and with diſhevelled hair.

Q. Where was her temple?

A. She had a temple at Rome, and her prieſts offered to her, as a ſacrifice, blood which flowed from wounds that they inflicted upon themſelves.

Q. Who is the goddeſs of wiſdom and the ſciences?

A. Minerva, or *Pallas*. She is repreſented completely armed, with an owl at her feet, becauſe that bird ſees in the dark, and intimates that true wiſdom never ſleeps.

Q. Where was ſhe worſhipped?

A. At Athens, where a moſt magnificent temple was erected to her honour. This goddeſs is emblematical of wiſdom, prudence, and conqueſt over vice and the paſſions.

Q. Who is the goddeſs of agriculture?

A. *Ceres*, daughter of *Saturn* and *Cybele*, who taught men the art of cultivating the land and ſowing ſeeds; for which reaſon ſhe has been honoured as the goddeſs of agriculture. She is painted as a beauty of the brunette kind, with ears of corn in her hand.

Q. What ſacrifices were made to Ceres?

A. Swine, becauſe they deſtroy the productions of the earth, and garlands compoſed of ears of corn.

Q. Who is *Somnus?*

A. The god of ſleep, ſon of Nox, who holds in his hands poppies, which ſerve for his pillow.

Q. Who is *Morpheus?*

A. The ſervant of Somnus, who can put on all ſhapes, and who preſents dreams to to thoſe that ſleep. Theſe dreams he brings from a great ſpreading elm in hell, under the ſhade of which they uſually ſit.

Q. Who is *Momus?*

A. The god of folly. He is reprefented with a mafk and grotefque face;—he was rather a jefter, mocker, or mimic of the gods, than a god himfelf.

Q. Why was he thus reprefented?

A. Becaufe he was always employed in examining the actions of gods and men, and reprehended them with freedom.

Q. Who is the god of ſilence?

A. Harpocrates, ſon of *Oſiris* and *Iſis*; he is always painted with a finger on his mouth.

Q. How is he painted?

A. Almoſt naked, in the figure of a boy, crowned with an Egyptian mitre; in his left hand is a horn of plenty, while a finger of his right hand is upon his lip, denoting the neceſſity of ſilence.

Q. Who was the inventor of medicine?

A. *Esculapius*, son of *Apollo* and the nymph *Coronis*.—He is generally represented under the figure of a serpent; but sometimes under that of an old man, holding a staff encircled by a serpent. He wears a crown of laurel, because that tree is powerful in curing many diseases. Dung-hill cocks are sacrificed to him on account of their vigilance, a virtue very necessary to physicians.

Q. By whom was he brought up?

A. By the centaur *Chiron*, from whom h learned physic. He was killed by Jupiter.

Q. For what reaſon ?

A. Becauſe Pluto complained that his empire over the dead was much diminiſhed by the art of Eſculapius.

Q. Where was he adored ?

A. At Epidaurus, a town of Peloponneſus.

Q. What goddeſs preſides over gardens and flowers ?

A. Flora ; and Pomona and her lover Vertumnus, over orchards and fruit trees.

Q. Who are the principal rural deities, or gods of the woods ?

A. The Satyrs or Fauns, who ranged over the country, but delighted chiefly in vineyards ; *Priapus*, an obſcure deity, whoſe buſineſs was to drive away birds, and guard the fruit from thieves ; *Ariſteus*, and *Terminus*, who was nothing but a boundary ſtone : beſides a great variety of nymphs ; as the Dryades, Arcades, &c. &c.

Q. Who was *Venus?*

A. She was the handſomeſt of all the goddeſſes, who, ſoon after ſhe was born, was carried by the Hours with pomp into heaven, where the gods found her ſo extremely beautiful, that they were deſirous of marrying her, and named her the goddeſs of love; her principal temples were at *Cytherea*, an iſle in the Archipelago, at *Paphos*, a town in Cyprus, and at *Amatonia*, another town in the ſame iſland.

Q. From what is ſhe ſaid to have been produced?

A. From the froth of the ſea.

Q. Had ſhe any children?

A. Yes; ſhe was the mother of *Cupid*, the god of love, whom they generally repreſent as a child of ſeven or eight years old, always naked, handſome, inclining to plumpneſs, and ſometimes a little idle and ſly. His quiver, bow, and darts, are continually mentioned to this day.

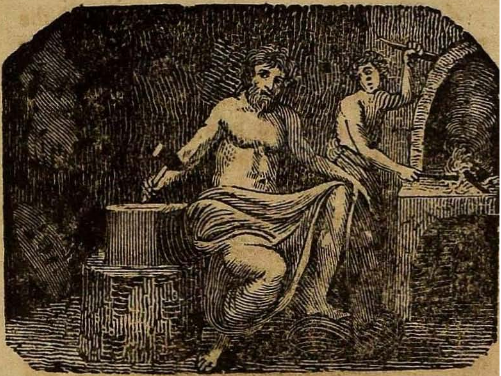
Q. Where were her principal temples?

A. Temples were erected to her honour every where, but the moſt celebrated were thoſe of Paphos, Gnidus, Amathus, Cythera, and Idalia. Cyprus was her favourite reſidence. The dove and the ſwan, the roſe and the myrtle, were conſecrated to her.

Q. Who are the attendants of *Venus?*

A. The three *graces*; their names are *Aglaia*, *Thalia*, and *Euphroſyne*. They are repreſented, generally, naked, like three beautiful ſiſters, and connected together,

Q. Whoſe wife was *Venus?*



A. She was the wife of *Vulcan*, the god of blackſmiths, and ſon of Jupiter and Juno. Vulcan being extremely ugly and deformed, as ſoon as he was born Jupiter kicked him out of heaven. In the fall he broke his leg, of which he always remained lame. He is repreſented with a fiery red face, whilſt at work with the Cyclops. This poor god is always the ſubject of pity and ridicule. His lameneſs ſerves to divert the gods.

Q. What was the figure of the Cyclops?

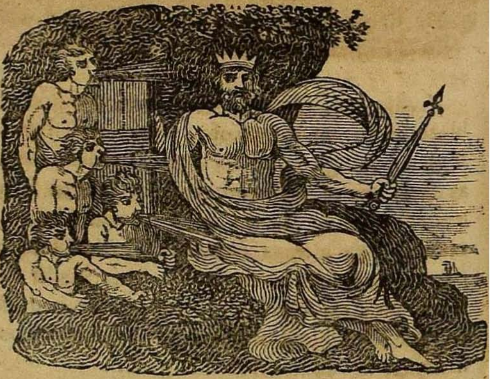
A. They had vaſt bodies, were extremely ugly, and had only one eye, in the middle of their forehead.

Q. What is ſaid of Vulcan?

A. That he was recalled to heaven, through the interceſſion of Bacchus, and re-eſtabliſhed in the favour of Jupiter.

Q. With whom did he marry?

A. Jupiter cauſed him to marry Venus, whoſe infidelities to her huſband have been ſtrongly marked out from the earlieſt ages. The poets, in particular, have never ſpared her; and often ſpeak of the public ſhame ſhe was brought to by her amours with Mars.



Q. Who was Æolus?

A. The god of the wind, tempeſts, and hurricanes.—Aquilo and Boreas are the cold

winds of the north ;—Eurus, or the genius of the eaft winds, prefided over all the eaftern quarter of the heavens ;—Zephyrus, or the weft wind, prefided over the weft, and is the mildeft of all the wind deities ; and Aufter, or Notus, the genius of the fouth wind, was the chief director of the fouth. Thefe wind deities were all brothers, fons of Aftræus, the elder brother of Saturn, by Aurora.

Of Parnaffus.

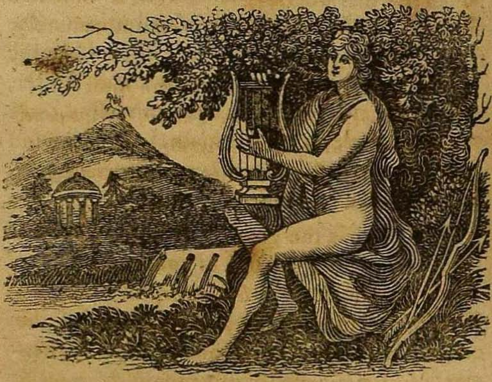
Q. What is mount *Parnaffus?*

A. The habitation of the nine *Mufes*, daughters of *Jupiter* and the goddefs *Mnemofyne*, and where *Apollo* prefides.

Q. How are the Mufes fometimes reprefented ?

A. They are frequently reprefented as furrounding Apollo, on mount Parnaffus or Helicon, while Pegafus, with extended wings, darts forward into the air.

Q. Who is *Apollo?*



A. Apollo was the ſon of *Jupiter* and *Latona.* He is the god of poetry and muſic, and in that character is repreſented with a lyre in his hand, and a crown of laurels on his head. He is alſo god of the ſun, and thence is generally called *Phœbus.*

Q. Where was he born?

A. At *Delos,* an iſland in the Ægean ſea.

Q. What is the river that flows at the foot of mount *Parnaſſus?*

A. Hippocrene, a f untain of mount *Helicon,* in *Bœotia.*

Q. How is it ſaid to have been formed?

A. The poetic horſe, *Pegaſus*, ſo often mentioned by the poets, gave a kick againſt the mount, and the river *Hippocrene* immediately ſprung out.

Q. What are the names of the muſes

A. *Calliope*, *Clio*, *Erato*, *Thalia*, *Melpomene*, *Terpſichore*, *Euterpe*, *Polyhymnia*, *Urania*.

Q. Over what particular ſcience does each muſe preſide?

A. *Calliope* is the goddeſs of heroic poetry; *Clio*, of hiſtory; *Erato*, of amorous poetry; *Thalia*, of comedy; *Melpomene*, of tragedy; *Terpſichore*, of dancing; *Polyhymnia*, of the ode; *Euterpe*, of muſic and muſical inſtruments; and *Urania*, of aſtronomy.

Q. How are they repreſented by the poets?

A. As very young, very handſome, and adorned with garlands of flowers.

Of the Demi-Gods, or Heros.

Q. What do we underſtand by a hero?

A. A title given by the Greeks to thoſe who had made themſelves famous.

Q. What is a demi-god?

A. A man born of a god, or goddeſs, by a mortal. There are infinite numbers of them.

Q. Who are the principal?

A. Æneas, Ulyſſes, Hercules, Theſeus, Achilles, and Jaſon.

Q. What is remarkable in the hiſtory of Æneas?

A. He was a Trojan prince, ſon of Anchiſes and the goddeſs Venus; he is memorable for his great care of his aged father, whom he bore through the flames of Troy upon his ſhoulders, at the hazard of his life, and his ſon's, a child, who was obliged to cling to his garments to eſcape them. Arriving in Italy, he married Lavinia, the daughter of Latinus, king of the Latins, and built Lavinium, ſo named after his wife. He died 1197 years before Chriſt.

Q. What is recorded of Ulyſſes?

A. That on his return by ſea from the Trojan war to the iſland of Ithaca, of which he was king, the Syrens uſed every effort to ſtop him; but that he might not be ſurpriſed by their melodious voice, he ſtopped his ears, and cauſed himſelf to be tied to the maſt of the ſhip.

Q. What are we told of his wife Penelope?

A. Beſieged by a numerous train of lovers in the abſence of her huſband, ſhe delivered herſelf by artifice. She promiſed to make choice of one of them, as ſoon as a piece of

tapeſtry, on which ſhe was at work, ſhould be finiſhed; but every night ſhe unwove all that ſhe had done the preceding day.

Q. Who was Hercules?

A. Son of Jupiter and Alcmene, wife of Amphytrion. He was expoſed through the whole courſe of his life to perform the moſt dangerous adventures, by the malignity of Juno, and the fatality of his birth. His principal exploits are termed, by way of eminence, the twelve labours of Hercules.

Q. Explain them.

A. 1. Whilſt a child in his cradle, he ſtrangled two ſerpents which Juno had ſent to deſtroy him.

2. He killed in the foreſt of Lerna, a frightful Hydra of fifty heads: when he cut off one of theſe heads, another immediately ſprung up in its place.

3. He caught and killed on mount Menalus an extremely ſwift hind, with horns of gold.

4. He overcame Diomedes, king of Thrace, who fed his horſes with the fleſh of his gueſts, and threw him to be eaten by his own horſes.

5. He took on the mountain Erimanthus, in Arcadia, a wild boar, that had made dreadful havock round the country, and dragged it alive to Euriſtheus.

6. He tamed a mad bull which laid deſolate Crete.

7. He conquered upon the banks of Tarſeſus, by the invincible force of his arm, Geryon, a giant of immenſe ſtature with three bodies, and carried away his flock.

8. He ſeparated the mountains Calpe and Abila, which were before joined, and now form the Straits of Gibraltar.

9. He carried away the golden apples from the gardens of the Heſperides, after he had killed the dragon that watched them.

10. He ſuffocated, in wreſtling, the giant Antæus.

11. To eaſe Atlas, he took the heavens upon his ſhoulders.

12. And laſtly, he is repreſented covered with the ſkin of a lion, of an amazing ſize, which he had conquered in the woods of Nemea.

Q. How did the life of this famous hero end?

A. Having ſlain the centaur Neſſus, the dying monſter gave Dejanira (Hercules's wife) a garment dipped in his own blood, as a preſervative for love. This Dejanira ſoon after ſent him to regain his affections. The hero had no ſooner put on the poiſoned ſhirt, than

he was ſeized with violent and incurable pains; therefore making a funeral pile on mount Oëta, he ſet fire to it, and cloſed, with the moſt dreadful agonies, a life of hardſhips for the good of his fellow-creatures.

Q. What is meant by the Heſperides?

A. They were the daughters of Heſperius, ſon of Japet, and brother of Atlas.

Q. What is ſaid of Atlas?

A. He was the ſon of Uranus, a great obſerver of the ſtars, and the firſt who repreſented the world by a ſphere.

Q. What is related of Theſeus?

A. He was the ſon of Ægeus, king of Athens, and Æthra, daughter of the wife of Pitheus, at whoſe court he was brought up by Trœzenus: he killed the Minotaur.

Q. What was this Minotaur?

A. It was a monſter which had a bull's head, and all his lower parts human. It was incloſed in the Labyrinth at Crete, made by Dædalus, by order of Minos, king of that iſle, the inhabitants of which ſacrificed men to Jupiter and Saturn; and where many of the gods and goddeſſes were born.

Q. Who was Perſeus?

A. Son of Jupiter and Danäe, daughter of Acriſius, king of Argos. He was king of the

Mycenians. He had the wings of Mercury, the ſhield of Minerva, the helmet of Pluto, and a ſword forged by Vulcan. Thus armed, he overcame and cut off the head of Meduſa. He alſo delivered Andromeda, daughter of Cepheus, king of Ethiopia, from a monſter, and afterwards married her. He lived about 1348 years before Chriſt.

Q. What is ſaid by the poets of the head of Meduſa?

A. That it was ſurrounded by ſerpents inſtead of hair, and turned to ſtones thoſe who had the raſhneſs to look upon it.

Q. What is remarkable in the hiſtory of Achilles?

A. He was the ſon of the goddeſs Thetis, daughter of Nereus and Doris, the moſt beautiful of the Nereides; and Peleus, ſon of the famous Æacus, king of Egina, and the nymph Endeis, daughter of Chiron: he was educated by the centaur Chiron. His mother dipped him in the Styx, all but the heel by which ſhe held him to make him invulnerable. He was ſlain at the ſiege of Troy by Paris, whoſe arrows ſhot him in the heel, 1180 years before Chriſt.

Q. What is a centaur?

A. A monſter, half man and half horſe.

Q. Who was Jaſon?

A. Son of Æſon and Alcymede. Upon the death of his father, he was placed under the tuition of Pelias.

Q. What is his ſtory?

A. At the perſuaſion of Pelias, he undertook the Argonautic expedition to Colchis for the golden fleece, which he carried away, about 937 years before Chriſt.

Q. What golden fleece was that?

A. The hide or fleece of a ram called golden, becauſe it was of a golden colour. It was guarded by bulls that breathed fire from their noſtrils, and by a vaſt and watchful dragon, in the grove of Mars.

Q. Who was Pelias?

A. Son of Neptune and Tyro.

Q. How was he brought up?

A. He was fed by a mare, and became the moſt cruel of all men.

Q. What did he when grown up?

A. He not only uſurped the eſtates of Jaſon, but cauſed him to be impriſoned.

Q. What elſe is recorded of him?

A. He ſacrificed his mother-in-law to Juno, and put to death the wife and children of Æſon; but Jaſon was ſaved from his fury, and educated in private.

Q. Who was Paris, and what was his judgment?

A. Paris was the ſon of Priam, king of Troy, and Hecuba. At the wedding of Thetis and Peleus, when Juno, Venus, and Minerva were preſent, the goddeſs of Diſcord threw into the aſſembly a golden apple, with this inſcription, "To the faireſt." Each of theſe three goddeſſes wanted to have the apple, and each ſaid ſhe was the faireſt. At length they agreed to be judged by Paris, at that time feeding his flock upon mount Ida, who decided in favour of Venus. He is memorable in hiſtory for carrying off Helena, wife of Menelaus, king of Mycenæ, in his abſence, which occaſioned the famous ſiege of Troy, where he was ſlain by Pyrrhus 1188 years before Chriſt.

Q. Who was Pyrrhus?

A. Son of Achilles, king of Theſſaly, and Deidamia, daughter of Lycomedia.

Q. What were the actions of this prince?

A. He was ſignalized for his cruelties.

Q. Mention ſome of them.

A. 1. He ſacrificed Polyxena, daughter of Priam and Hecuba, upon the tomb of Achilles.

2. He maſſacred Priam at the foot of the altar.

3. He carried Andromache with Aſtyanax into Epirus.

. Who was Andromache?

A. Daughter of Ætion, king of Thebes, wife of Hector, and mother of Aſtyanax.

Q. What more did he?

A. Arrived in Epirus, he is ſaid to have thrown Aſtyanax from a high tower, and to have married Andromache.

Q. How did he die?

A. Hermione, his wife, daughter of Menelaus and Helena, prevailed upon Oreſtes, ſon of Agamemnon and Clytemneſtra, with the promiſe of marriage, to aſſaſſinate him.

Q. Where did he accompliſh this crime?

A. In the temple, at the celebration of a ceremony.*

* A fuller and more complete Account of the Ancient Mythology may be found in Tooke's Pantheon. The new Edition of this work is embelliſhed and illuſtrated with a ſeries of beautiful engravings, taken from antique ſtatues, &c.

APPENDIX.

NATURAL HISTORY.

Q. WHAT do you mean by natural hiſtory?

A. An account of the different productions of nature, whether they belong to the animal, the vegetable, or the mineral kingdoms.

ANIMALS.

Q. What are the principal members of the animal kingdom?

A. Birds, beaſts, and fiſhes.

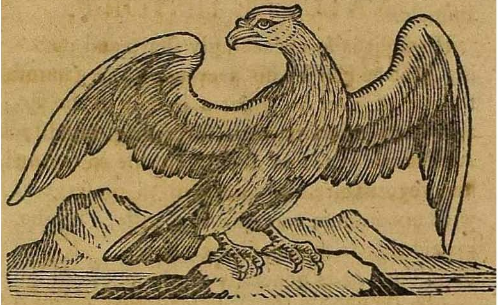
BIRDS.

Q. Which are the principal or moſt remarkable birds?

A. The eagle, the oſtrich, the ſwan, the cuckow, the nightingale, the humming-bird, the peacock, the vulture, the hawk, the kite,

the owl, the parrot, the raven, the turkey, the pheaſant, the lark, the goldfinch, the linnet, the canary-bird, the crane, the pelican, the cormorant, &c.

THE EAGLE.



Q. What are the chief properties of the eagle?

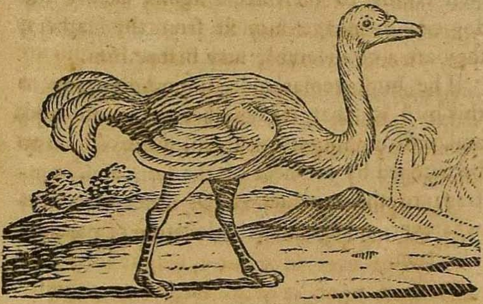
A. There are many kinds of eagles; but that called the golden eagle is the largeſt, and is commonly called the king of birds. He is found in the deſerts of Arabia, and the northern parts of Aſia and Europe. He is a bird of great ſtrength, exceedingly bold, and very

voracious and fierce in devouring his prey. He is of a great ſize, nearly four feet long from the point of the bill to the end of the tail; and between the points of each wing, when extended, nearly ſix feet: his beak is very ſtrong, crooked, and ſharp; ſo alſo are his talons and claws. His common prey is hares, rabbits, kids, lambs, &c. but when preſſed by hunger they will ſeize on larger animals.

His ſight is ſo exceedingly ſharp and piercing, that he can ſee his prey upon the ground though at ever ſo great a height in the air, and darts upon it with ſurpriſing rapidity. And as his eye is of ſuch great uſe in ſpying his prey, nature has contrived to preſerve it with uncommon care, having, inſtead of one, provided it with four lids or covers. Eagles build their neſts generally on the ſides of high and inacceſſible rocks, or on the tops of old decayed large trees, and ſeldom lay above two eggs at a time.

Their legs are feathered down to the feet, of a duſky colour; the feet are yellowiſh. They have four talons, very ſharp and crooked. They are ſaid to live to a prodigious age, though the exact time is uncertain.

THE OSTRICH.



Q. What is the oftrich?

A. It is generally thought to be the largeft, at leaft one of the talleft birds in the world, being, when it holds up its head, not lefs than feven or eight feet high. It is found both in Africa and Arabia, particularly in the fandy deferts of Arabia. The head and bill refemble thofe of a duck. The wings of oftriches do not feem made for flying, but only to affift them in running, which they do with great fwiftnefs; they can run a long time without hurting their feet, which are armed with a kind of horny fubftance.

They are frequently hunted with greyhounds, and, when in danger of being taken,

they ſuddenly ſtop, let down one of their wings, and covering their whole body with it, ſuffer the dog to get his mouth full of feathers; then taking to their heels again, before the dog can diſengage himſelf from the feathers, they are a conſiderable way before him.

The moſt remarkable thing belonging to this bird is, that it lays its eggs in the ſand, and, entirely forgetting them, ſuffers them to be hatched by the heat of the ſun, and, contrary to the conduct of all other creatures whatever, appears utterly deſtitute of parental affection.

THE SWAN.

Q. What have you to ſay of the ſwan?

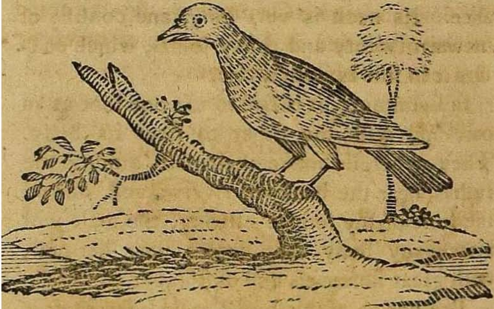
A. The ſwan is one of the principal of thoſe amphibious web-footed birds that live

either by land or water. It is a large and ſtately bird, of a milk-white colour, and on a fine canal or river makes a beautiful appearance. Its neck is very long, and conſiſts of between twenty and thirty joints, which enables it to fiſh as with a line.

In ſwimming, it is ſaid to uſe one foot as an oar, and with the other to ſteer its body. They generally make their neſts among the ruſhes, near the banks of rivers; and, during the time of the female's ſitting, the male will attack any body that comes near her neſt, with great fierceneſs and obſtinacy.

The notion of this bird's melodious ſinging before it's death is a vulgar error, and might probably take its riſe from the fable of the ancients, that the ſoul of Orpheus, the old Greek poet and muſician, paſſed by tranſmigration into the body of a ſwan.

THE CUCKOW.



Q. What kind of bird is the cuckow?

A. It is about the bigneſs of a magpie; its length, from the tip of the bill to the end of the tail, being about twelve inches. The throat, breaſt, and belly are white. The feathers of the head are of a dark brown, with white edges. The neck and back are brown, with a tincture of red; the rump is aſh-coloured.

The cuckow herſelf builds no neſt; but having found the neſt of ſome little bird, ſhe either devours or deſtroys the eggs ſhe finds there, and in the room lays one of her own, and ſo forſakes it. The ſilly bird returning, ſits on this egg, hatches it, and with great care and toil broods, feeds, and cheriſhes the young

cuckow for her own, until it is grown up and ready to fly, and ſhift for itſelf. This ſeems a thing ſo ſtrange and unnatural, that Dr. Willoughby, in his Ornithology, ſays he could not have believed it to be poſſible, unleſs he had ſeen it with his own eyes.

THE NIGHTINGALE.

Q. What have you to ſay of the nightingale?

A. Of all ſinging birds this is allowed to be the chief; his notes are ſweeter, more melodious, and more various than the notes of any other bird. And what is remarkable, he begins to ſing, or at leaſt continues to do ſo, after all the others have ceaſed, as if conſcious to himſelf that his muſic deſerved a more particular regard.

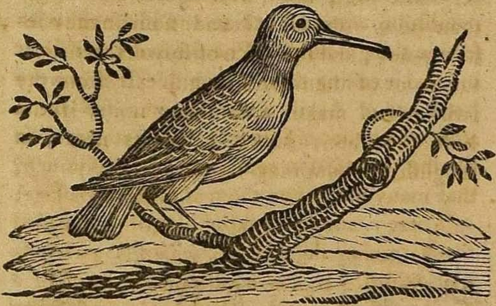
It is very rare that one can get a ſight of theſe evening muſicians; but the beauty of their feathers is not at all equal to the melody of their ſongs, their colour being a duſky reddiſh brown; and in ſize and ſhape they reſemble the goldfinch. The time of their ſinging and breeding their young ones is from the latter end of April to the beginning of June, after which they are never either heard or ſeen till the ſame ſeaſon returns again: inſomuch, that many look upon them as birds of paſſage.

There is another kind of nightingale, called the Virginian nightingale, which is as big as a blackbird. It has a tuft on its head of a ſcarlet colour; with which colour alſo the neck, breaſt, and belly are adorned. The ends of the wings are not of ſo deep a red, neither is the tail. The colour of the whole is a lovely ſcarlet, only the head and tail more faint.—Upon ſeeing its image in a glaſs it has ſtrange geſticulations, making a hiſſing noiſe, lowering its creſt, ſetting up its tail like a peacock, ſhaking its wings, and, in a word, ſtriking at the looking-glaſs with its bill.

Q. How many kinds of owls are there?

A. Not leſs than four; the common owl, the horned owl, the grey owl, and the fern owl. The common barn owl is to be found in moſt parts of England.

THE HUMMING-BIRD.



Q. Is not the humming-bird a very ſingular creature?

A. It is the ſmalleſt of all birds. The head, together with the feathers on it, is of the bigneſs of a middle-ſized cherry: the neck is three quarters of an inch long: the body an inch and a quarter. The body, together with the feathers, is ſcarcely equal in bigneſs to a Spaniſh olive. Its colour is wonderfully reſplendent, ſo that it cannot be well repreſented by any painter; for with ſuch a green as is ſeen in the necks of peacocks, a golden flame-colour, and a yellow, are curiouſly mixed; ſo that when it is expoſed to the ſun it has a moſt

ſhining appearance. It makes its neſt in the boughs of trees, of the bigneſs of a Dutch ſhilling; and lays very white eggs, two for the moſt part, of an oval figure, not bigger than peas. It is fed and nouriſhed with honey-dew, and the juice of flowers, which it ſucks out of them with its bill. It flies very ſwiftly, and makes a humming noiſe, like a hornet or bee; hence it has its name, in Engliſh, of humming-bird.

THE PEACOCK.

Q. What have you to obſerve with regard to the peacock?

A. The peacock is a bird well known, and ſufficiently diſtinguiſhed by the length and glorious eye-like ſpots of his tail. His head,

neck, and the beginning of his breaſt, are of a deep blue. It has a tuft on the top of its head, conſiſting of a kind of naked but very tender green ſtalks, or ſhafts of feathers, bearing on their tops, as it were, lily flowers, of the ſame colour. The neck is long, and for the bigneſs of the fowl, very ſlender. The back is of a pale aſh colour, beſprinkled with many black ſpots. The rump is of a deep green.

The long feathers of the tail are of a cheſnut colour, beautified with moſt elegant gold lines, tending upwards, but ending in tips of a very deep green, and thoſe forked, like ſwallows' tails. The circular ſpots, or the eyes of the feathers, are party-coloured, of a deep green, ſhining like a chryſolite, a gold, or a ſapphire colour: for thoſe eyes conſiſt of four circles of different colours; the firſt golden, the ſecond a cheſnut, the third a green, and the fourth or inner place is taken up by a blue or ſapphire-coloured ſpot, almoſt of the colour and bigneſs of a kidney-bean.

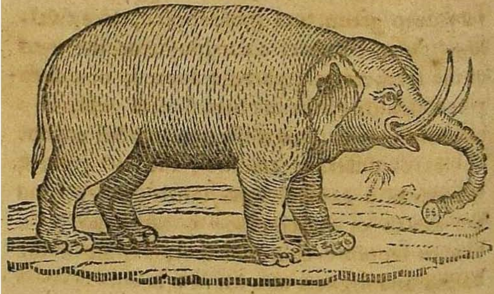
The hips, legs, and feet are of an aſh colour, with black ſpots. The belly, near the ſtomach, is of a blueiſh green. Its food is the ſame with the common cock and hen.

BEASTS.

Q. What are the moſt remarkable beaſts?

A. The elephant, the beaver, the zebra, the lion, the panther, the leopard, the tyger, the rhinoceros, the porcupine, the cameleon, the camelopard, the rein-deer, the crocodile, &c.

THE ELEPHANT.



Q. What is the elephant?

A. The elephant is the largeſt of all land animals; and it is at leaſt equal, if not very ſuperior, to any in underſtanding and ſagacity. Elephants are bred only in hot countries, ſuch as the Eaſt Indies and Africa. They are fre-

quently eleven or twelve feet high, and many of them much higher. Their make is very clumſy, and their ſtrength prodigious. Their colour is generally a mouſe dun or black; and the ſkin of their ſides and back is ſo hard, that it is not eaſily pierced, even by a ſword or ſpear.

Their eyes are ſmall, ſomething reſembling thoſe of a ſow, but very red. They have four teeth on each ſide, with which they grind their meat; and two large tuſks, which hang out of their mouths, and grow to a prodigious ſize, frequently more than a hundred weight each. Theſe they caſt every tenth year, and by that means afford a very valuable commodity to the natives, who exchange theſe ivory teeth with the Europeans for many other wares.

But the moſt remarkable part of the elephant is his proboſcis or trunk. This is a large hollow, griſtly membrane, hanging down from the upper part of the noſe towards the ground; and is ſo admirably contrived, ſo curiouſly wrought, and applied by the creature to its various occaſions with ſuch ſurpriſing facility and addreſs, as plainly ſhews it to be the workmanſhip of an almighty creator.

Another thing remarkable in the elephant is, that the nipples of the female are placed near her breaſt. The reaſon of this is, that ſhe is

forced to ſuck her own dugs, and by the help of her trunk to convey the milk into the mouth of her young. The time of her going with young is two whole years, and the length of their life is generally thought to be upwards of a hundred. Elephants live upon plants and roots, which they dig out of the earth with their tuſks, or upon the fruit or branches of trees, which they pull down with their trunks.

They are, when tamed, extremely docile; and the various uſes that the ancient Indians and ſome other nations made of them in war are aſtoniſhing. Many thouſands of them have at once been led to battle, armed with various weapons, and taught to exerciſe their trunks with a miſchievous dexterity. They were alſo very uſeful in throwing down trees, houſes, walls, or whatever obſtructed the march of an army.

Large wooden towers alſo were frequently fixed upon their backs, capable of containing 15 or 20 men armed with ſpears and javelins, which, from ſuch an elevation, they darted at their enemies with great advantage. Yet it frequently happened, that theſe creatures occaſioned as much confuſion in the army to which they belonged, as in that of their enemies; and for this reaſon the uſe of them in war has been long ſince laid aſide.

Our own queen had a preſent made her of two elephants ſoon after her marriage; and ſhe kept them (with a zebra) in her mena gerie at Pimlico till they died.

THE BEAVER.

Q. I have heard a great deal of the beaver, pray what kind of an animal is it?

A. The beaver is about four feet in length, and its breadth twelve or fifteen inches. His fur, in northern countries, is generally of a blackiſh colour; but, in the more temperate climates, it brightens into a reddiſh tincture. He is covered with two ſorts of hair, one long and hardiſh, the other a ſoft down, which is manufactured into ſtuffs, hats, or ſtockings.

They have a large broad tail, which is covered with ſcales, almoſt like thoſe of a fiſh.

Both the male and the female have two bags under their bellies, impregnated with a liquid ſubſtance, called by the phyſicians *Caſtoreum*, and, when prepared by the chemiſt, *Caſtor Drops*, or *Tincture of Caſtor*. It is preſcribed as an excellent remedy againſt poiſons, and many indiſpoſitions.

What is moſt remarkable in theſe creatures is, their great ſkill as architects. They build their apartments, or one may rather call them towns and cities (for they aſſociate together in great numbers), with ſurpriſing art and dexterity. When they have found a convenient ſituation on the banks of a river, their next care is to ſeek out for proper timber to ſupport the roofs of their ſubterraneous dwellings. For this purpoſe they pitch upon a tree, perhaps about as thick as a man's leg, which they gnaw with their teeth till they have cut it down.

Then they go to work upon the branches, and break them into pieces of one, two, or three feet long, according to the uſes for which they intend them. And when theſe, which are the main joiſts and ſupporters, are diſpoſed of according to their mind, they then weave or wattle them with ſmaller twigs,

and incruſt over the whole with a plaiſter or cement, which ſerves either to keep out inundations, or to preſerve the waters in reſervoirs for their own uſe; againſt inundations they are generally provided with upper apartments, which they retire to when the floods ariſe, and deſcend from when the waters ſubſide.

THE ZEBRA.

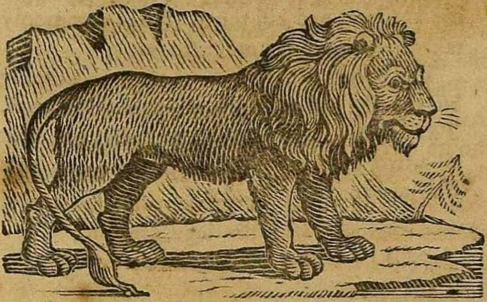
Q. As you mentioned the zebra, which the queen kept with her elephants, I ſhould be glad to have ſome ſhort account of that animal?

A. This, which is commonly called the wild afs, is an extremely beautiful creature; and though in colouring it differs fo much from all other kinds and varieties of the horfe, yet it agrees with it in all other refpects. It is about equal to the common afs in fize, but of a much more elegant figure.

The head is fmall and fhort, the ears are long, the eyes large and bright, and the mouth very large. The neck is long and flender, but elegantly turned; the body is rounded, and fmall in proportion to that of the common afs; the legs are long and flender; the tail long and beautiful, but hairy only at the end.

The whole animal is party-coloured, or beautifully ftriped, in a crofs direction, with long and broad ftreaks, alternately, of a deep, gloffy, and fhining brownifh and whitifh hue, and with fome that are abfolutely black. It is a native of many parts of the eaft.

THE LION.



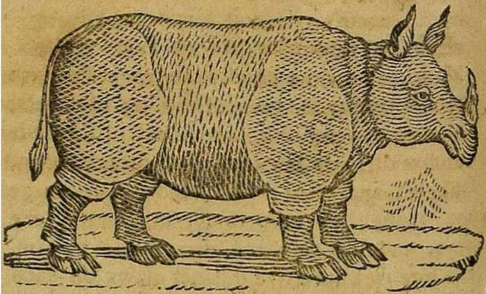
Q. What kind of animal is a lion?

A. The lion, on account of his great ſtrength and fierceneſs, is called the king of beaſts, and is in general of a dun colour. The hair of ſome of them is curled; of others, long, ſhagged, and thin. His head is very large and ſtrong, his noſe thick, his mouth very wide, and his eyes red, fiery, and hollow. His fore feet have five diſtinct claws on each foot, and the hinder but four; all crooked, ſharp, and exeeedingly hard. His ſight and ſmelling are very acute, and he ſleeps with his eyes open. He cannot endure fire.

When other wild beaſts hear his roaring, they are ſtruck with terror, and dare not ſtir; though he himſelf is not without fear from ſome creatures, ſuch, for inſtance, as the great dogs of India, with which it is ſaid the Indians hunt and kill them. He is commonly taken with nets and other ſnares.

The lioneſs differs from the lion in nothing but that ſhe has no mane, which the other has. The panther, the leopard, and the tyger, bear all a ſtrong reſemblance of the lion, only that they are curiouſly ſpotted.

THE RHINOCEROS.



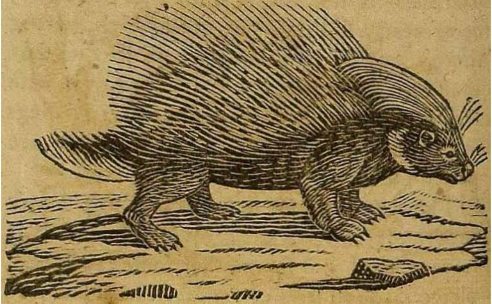
Q. What is the rhinoceros?

A. The rhinoceros, ſo called becauſe of the horn in his noſe, is bred in India and Africa.

His colour is like the bark of a box tree. He is ſaid to be in ſhape ſomewhat like a wild boar, and is not much unlike an elephant; being nearly ſo long, but not ſo high, having ſhorter legs. His ſkin is ſo hard that no dart is able to pierce it, and is covered over with ſcales, like the ſhell of a tortoiſe. His legs ſcaled over down to the hoofs, which are parted into four diſtinct claws.

The horn upon his noſe, which bends backwards towards the crown of his head, is ſo very hard and ſharp, that ſome ſay it will pierce through iron or ſtone. He is ſaid frequently to whet his horn againſt a flint, that he may be prepared, whenever he is attacked by an enemy. He is a mortal foe to the elephant, whom he ſeldom meets without a battle, and aims chiefly at his belly, being the ſofteſt place, which, if he miſſes, the elephant is too hard for him with his trunk and teeth. Naturaliſts ſay, that he grunts like a hog.

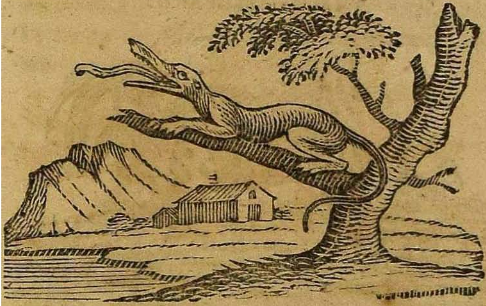
THE PORCUPINE.



Q. What is the porcupine?

A. It is a very curious animal, being covered with prickles or ſpines, and alſo with briſtles like thoſe of a hog. The ſpines, or quills (as they are called) are of two ſorts; ſome being ſhorter, thicker, ſtronger, and more ſharp-pointed; and others longer, weaker, and more flexible. The firſt of theſe, when the creature is provoked, it will ſhoot with ſuch violence, that if they happen to light on a board, they will ſtick in it; but this diſcharge of its natural weapons of artillery, if too frequently repeated, will tend in time to weaken the animal. Its fleſh, in thoſe countries where it breeds, is eſteemed by the natives as good food.

THE CAMELION.

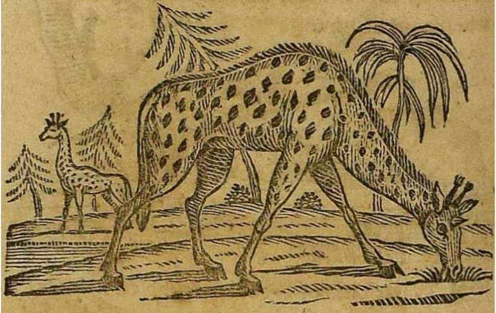


Q. What kind of creature is the cameleon?

A. The cameleon is very rarely to be ſeen. It is aſſerted by ſome naturaliſts that it lives on air; though others, who have diſſected it, affirm, that they have found flies in its belly. It is ſaid frequently to change its colour, very often three or four times in half an hour. Its uſual colour is grey. The colour it moſt commonly changes to is a fine green, ſpotted with yellow. Its ſkin is very thin, and almoſt tranſparent.

Its tongue is as long as its whole body. It is ſaid to be ſo timorous, that, when it deſcends from any height, it moves very cautiouſly, and curls its tail, by which it holds faſt about ſomething or other in its way, leſt it ſhould ſlip.

THE CAMELOPARD.



Q. What have you to ſay of the camelopard?

A. This creature is bred in Ethiopia, India, Georgia, &c. The head of it is like a camel's; its colour, for the moſt part, red and white, beautifully mixed together, and the ſkin full of ſpots. It has two little horns upon its head, of the colour of iron; has a ſmall mouth, like a hart's; a tongue nearly three feet long, and a neck of divers colours, of a very great length, which it holds higher than a camel's, and is far above the proportion of its other parts.

His fore feet are much longer than the hinder. His pace is different from that of all other beaſts; for he moves his two right feet

and his two left feet together. This creature is both like a camel and panther. Its ſkin is very valuable. It is a ſolitary beaſt, and keeps in the woods, and is never taken but when caught young.

THE REIN-DEER.

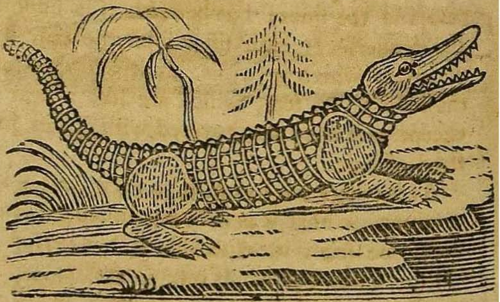
Q. What have you to obſerve of the rein-deer?

A. This creature is chiefly found in Lapland. It is ſomewhat bigger than a ſtag. Its horns branch out into ſeveral ſmall ones. Its feet are as thick as a bull's. It is of an aſh colour, but white on the belly and haunches. It rather reſembles an aſs than a ſtag. Though it be cloven footed, it does not chew the cud. It is naturally wild; but, when tamed, it an-

ſwers many domeſtic purpoſes, ſuch as drawing a ſledge or cart, or carrying a burthen.

In ſummer it feeds on graſs and the leaves of trees; and, at other times, on a ſort of white moſs, which grows in Lapland. When the ground is covered with ſnow, it ſcrapes out this moſs with its feet. It comes to its full growth at four years of age, and ſeldom lives above ten. With the milk of this creature the Laplanders make cheeſe, but no butter. It runs over the ſnow with ſurpriſing rapidity, and equal ſteadineſs.

THE CROCODILE.



Q. What have you to ſay of the crocodile?

A. The crocodile is a creature that lives both by land and water. It is of a ſaffron

colour, that is, between a yellow and a red, but more inclining to yellow. The belly is ſomewhat whiter than the other parts. Its body is rough, being covered all over with a certain bark, or rind, ſo thick, firm, and ſtrong, that it will not yield to a cart-wheel, even when the cart is loaded. In all the upper parts, and the tail, it is impenetrable by any dart or ſpear; but the belly is ſofter, and there it is more eaſily wounded.

When it opens its mouth it does not move its under jaw, like other animals; on the contrary, it moves the upper. Its tail is nearly as long as its whole body; and it is alſo rough, and armed with a hard ſkin upon the upper part and the ſides; but beneath it is ſmooth and tender. It hath fins upon the tail, by means of which it ſwims, as it alſo does by the help of its feet, which are like a bear's, except that they are covered with ſcales inſtead of hair.

As its legs are ſhort, it is very ſlow in its motions, ſo that it is no very difficult matter to eſcape from it, eſpecially if the perſon it purſues turns and winds out of the direct path; for the crocodile's body is ſo hard and ſtiff, that it cannot eaſily turn and wind after him.

It is common in the Weſt-Indies, and ſtill more upon the banks of the river Nile, in

Egypt, where it is ſaid to lie hidden amongſt the reeds and ruſhes, till it finds an opportunity to ſeize men or other animals, which it drags into the water, always taking this method of drowning them firſt, that it may afterwards ſwallow them without reſiſtance. Its general food, however, is fiſh.

It is a wily cunning creature; and it is ſaid, that when it ſees a ſingle man whom it is deſirous of drawing into its clutches, it will weep and make a moſt lamentable moan, as if it were in the utmoſt diſtreſs, till it has drawn him near enough for its purpoſe, when, ſuddenly ſpringing upon him, it beats him down with its tail, and immediately deſtroys him. This is beautifully deſcribed by our old poet Spenſer, in that paſſage where he compares the dangerous diſſimulation and treacherous tears of Dueſſa (or Falſehood) to the crocodile.

As when a weary traveller, that ſtrays
By muddy ſhore of broad ſeven-mantled Nile,
Unweeting of the perilous wand'ring ways,
Doth meet a cruel, crafty crocodile,
Which, in falſe guiſe hiding his harmful guile,
Doth weep full ſore, and ſhedding tender tears;
The fooliſh man, that pities all the while
His mournful plight, is ſwallowed up unawares,
Forgetful of his own that minds another's cares.

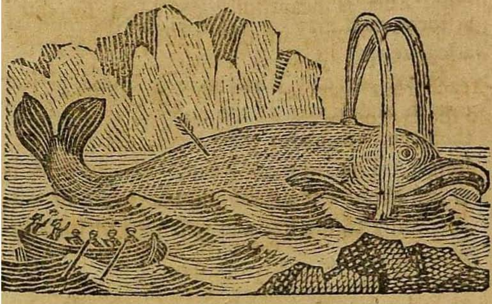
Hence it is, that hypocritical or affected grief and weeping is, by the common proverb, ſtyled *Crocodile's Tears.*

FISHES.

Q. What are the moſt remarkable fiſh?

A. The whale, the ſhark, the ſalmon, the tortoiſe, the turbot, the flounder, the haddock, the whiting, the herring, the mackerell, &c.

THE WHALE.



Q. What are the chief properties of the whale?

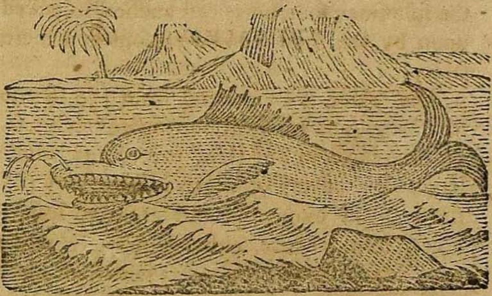
A. A whale is the largeſt of all fiſh, and indeed of all living creatures, whether by ſea

or land; for what we have been told of the Craken, which, according to thoſe who pretend to have ſeen it, reſembles an iſland rather than an animal, and in whoſe body, it is ſaid, the fiſhermen ſometimes caſt anchor, is looked upon by the moſt ſenſible perſons as a mere fable.

The whale is in general from 150 to 200 feet long, and of a proportionate thickneſs. Its head is about one third part of its whole length, on the top of which is what they call the hovil or bump; in this are two ſpout-holes, from whence, either in ſport or when wounded, it throws the water with ſuch force that it roars like a hollow wind, or the ſea in a ſtorm, and may be heard at the diſtance of a league.

What we call whalebone is found in the mouth and throat of the animal, in moſt of them perhaps about 500 pieces, each 15 feet long. The whole produce of a whale is worth about a thouſand pounds, more or leſs, according to the ſize and goodneſs of the fiſh.

THE SHARK.



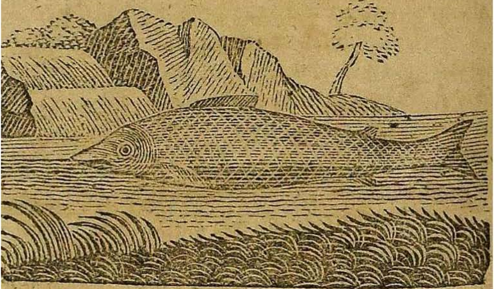
Q. What kind of fiſh is the ſhark ?

A. It is very large, and reckoned the boldeſt of all fiſh. Rondelitus ſays, that he ſaw a middling one that weighed almoſt a thouſand pounds.—Gillius ſays, that he was credibly informed, that a fiſh of this ſort, not weighing leſs than four thouſand pounds, being diſſected, had a whole man found in his belly. He further adds, that the people of Marſeilles told him, that they had caught one, in which they found a man armed with a coat of mail.

The fiſh is common in the Weſt Indies, and is very deſtructive to thoſe that amuſe themſelves with ſwimming; it will ſome-

times bite a man aſunder, and at other times take off a limb at leaſt; yet it is often caught and eaten by the ſailors.

THE SALMON.

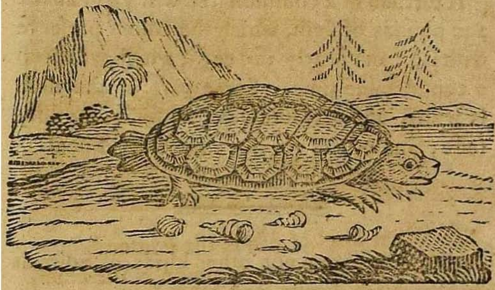


Q. What kind of fiſh is the ſalmon?

A. Of all river-fiſh the ſalmon is the chief, though whether it can be properly called a river-fiſh or not, is doubtful. Salmon enter the freſh water about February or March, where they continue till autumn, when they return again to the ſea. It is ſaid by thoſe who are acquainted with theſe fiſh, that the ſalt water beſt promotes their growth, but that freſh water moſt contributes to make them fat. The agility of theſe fiſh in leaping over weirs, or any other obſtacles which

oppoſe their paſſage to or from the ſea, is ſurpriſing. They have been obſerved to throw themſelves up cataracts and precipices many yards high; and when it ſo happens that their paſſage is effectually obſtructed, they ſoon grow lean and ſickly, and in a year or two's time languiſh away and die.

THE TORTOISE.



Q. Is not the tortoiſe a very curious fiſh?

A. The tortoiſe is an amphibious animal, living both by land and water. It is covered with an oval ſhell, beautifully clouded, and marbled with various colours, of which are made ſnuff-boxes, combs, &c. It is a dull, ſtupid animal, its brains being no bigger than a ſmall bean, though its head is almoſt as big as a calf's.

They feed upon mofs, grafs, or fea-weed. They are produced from eggs, as big as thofe of a hen, only round as a ball, of which they lay feveral hundreds in a feafon, near the fea-fhore, covering them with fand; and, about twenty-five days after laying, the eggs are hatched by the heat of the fun, and the little turtles, being about as big as young quails, run directly to the fea.

A tortoife of a common fize will yield about 200 pounds of flefh, which the failors preferve with falt; and nearly 300 eggs, which will keep a confiderable time. Some part of the flefh is white, and eats like veal, without any fifhy tafte; and others are like mutton and beef.

Q. Are there not other kinds of animals befides birds, beafts, and fifhes?

A. Yes; there are ferpents and infects, fome of the laft of which are very curious, fuch as bees, ants, and filk-worms.

Q. What kind of creature is a filk-worm?

A. The filk-worm is produced from a fmall egg, not much bigger than a muftard-feed, is of a pale afh-colour, and feeds on mulberry-leaves, or, for want of thefe, on leaves of

lettuce. During its continuance in this ſtate, it ſuffers four returns of ſickneſs, each laſting about three days, wherein it feeds not at all, but grows thicker, ſhorter, and clearer, and in each ſickneſs changes its ſkin.

Soon after this, it begins to wind itſelf up into a ſilken bag or caſe, about the ſize of a pigeon's egg, in which ſtate it lies incloſed about fifteen or twenty days without any food, and ſeemingly without life or motion, and is then transformed into an aurelia, or chryſalis, and, eating itſelf a paſſage out of the end of its ſilken ſepulchre, becomes a moth, which is its laſt ſtate, the ſtate in which it lays eggs and dies.

Theſe eggs are kept for about ten months, till the proper ſeaſon returns, which is the beginning of May, and then they hatch of themſelves into ſilk-worms. Thoſe who keep theſe inſects never ſuffer them to eat their way out of their ſilken habitation, becauſe that would ſpoil their work; but towards the end of their continuance in that ſtate, they wind the ſilk from off them, and the incloſed worm aſſumes its new ſtate of a moth, as well as if it had continued the whole time in its ſilken covering.

The quantity of filk generally wound from one of thefe balls or cafes is about 930 yards; but fo extremely fine is the thread, that the weight of it is not above two grains and a half.

Q. I have heard a great deal of the bees, and fhould be glad to receive a more particular account of them.

A. All that can be faid with regard to thefe noble and ufeful infects, may be reduced to three heads, viz. their government, their œconomy, and their manner of working.—That they are fubject to laws and government is afferted by all who have made obfervations upon them; and there is in every hive a certain bee of a larger fize than the reft, which is looked upon by the community as their monarch, and obeyed with great loyalty.

Moft naturalifts are now of opinion, that this fovereign is a female, and the mother of all the hive: that thofe we call drones, which are larger and of a darker colour than the common bees, and of which there are not above 4 or 500 in each hive, are males; and that all the common working bees are neither male nor female.

Thofe who are furnifhed with glafs hives, have been enabled to make many curious ob-

ſervations. They tell us, the queen has her apartments in the upper part of the hive; and when ſhe appears in public, which is ſeldom, ſhe walks with a ſedate and majeſtic air, and is attended by ſeveral large bees, (probably the drones or males), who follow her with reſpect, or form a circle, and, fluttering their wings, ſeem mightily rejoiced to ſee her: that in caſe of calamity they take great care of her; and if, by any misfortune, they are deprived of her, they neglect all buſineſs, as having no proſpect of poſterity to provide for, and either fly away at random, or languiſh and die.

As to their œconomy, all the buſineſs of the hive is carried on with ſurpriſing regularity, and the moſt entire union reigns throughout the whole community. Their habitations are in common; their food and proviſion in common; their labours all in common; their cares of poſterity in common; they ſympathize with one another in common danger, and with the greateſt courage and reſolution fight for one another.

They have no ſelfiſh views, no claſhing nor interfering intereſts, but are perfectly happy in their united endeavours, which produce that affluence and plenty that conſtitute the riches

of the whole community, and of every individual. They are patient of affronts when fingle, and at a diftance from their hives; but when within the reach of affiftance from their fellows, they will not be difturbed from their labours without refenting it.

United, however, as the bees are, and refolute in defence of one another, they are fometimes expofed to enemies that they are unable to refift. One of their moft formidable enemies is the moufe, which in cold weather, when the bees are not in vigour, will enter in at the mouth of the hive, and firft gnaw the lowermoft part of the comb, where there is but a little honey; but becoming bolder as the cold weather increafes, it afcends into the hive, and feizes on thofe combs which are next to the fides of the hive, where commonly the richeft honey lies, and will eat holes through them, and fo come and go through them at pleafure.

This attack of the moufe expofes them to other enemies, viz. the bees of other hives, who, fmelling the frefh honey, come in like thieves when a neighbour's houfe is on fire, not to help, but to plunder them of their remaining goods. Befides the moufe, the chief enemies of the bee are the moth, the ear-wig,

the hornet, the waſp, the ſwallow, and the ſparrow, all of whom ſometimes commit terrible devaſtations among them.

As to their manner of working, it is more aſtoniſhing than any other part of their hiſtory. When they begin to build their combs, they divide themſelves into four bands; the firſt of which is conſigned to the fields, to collect materials for the ſtructure, which chiefly conſiſt of the fine duſt they gather from flowers, and which, mixed with a certain gluey ſubſtance, is made into wax. The ſecond work upon theſe materials, and form them into a rough ſketch of the dimenſions and partitions of the cells, which are built hexagonal (that is, having ſix angles) with the niceſt mathematical exactneſs. The third examine and adjuſt the angles, remove the ſuperfluous wax, and poliſh and complete the work; and the fourth are waiters, who ſerve theſe labourers with proviſions during the time their work is in hand. And ſuch is their diligence and induſtry, that generally, in a fortnight's time, the whole hive is filled with combs.

Bees ſwarm moſtly in May and June, though ſometimes in April and July. They are very ſhort-lived creatures; few of them, it is thought, live above a year.

Q. I ſhould be equally obliged to you if you would give me ſome account of the ant.

A. As bees may be ſaid to live under a monarch, ſo ants ſeem to form a kind of commonwealth or republic; and their induſtry appears to have been as well underſtood in ancient as it is in modern times. "Go to the ant, thou ſluggard," ſays Solomon, "conſider her ways, and be wiſe, which, having no guide, overſeer, or ruler, yet provideth her meat in the ſummer, and gathereth her food in the harveſt."

The inſide of an ant-hill is a kind of oblong city, divided into various ſtreets, that terminate at different magazines. Some of the ants conſolidate the earth, and prevent its falling in, by incruſting it over with a ſurface of glue. Others amaſs ſeveral ſplinters of wood, which they draw over the tops of the ſtreets, and uſe them as rafters to ſupport the roof, and acroſs theſe they lay another row of ſplinters, and cover them with a heap of ruſhes, graſs, and ſtraw; this they raiſe with a double ſlope, to turn the current of the water from their magazines, ſome of which are appropriated to receive their proviſions, and in others they depoſit their eggs.

Theſe eggs produce maggots, which after a time ſpin themſelves coverings, and become *Aurelias*, and then ants. The affection of the parents for their young in the aurelia ſtate is ſo ſtrong, that, when danger threatens, they inſtantly run away with them, and will ſooner die than leave them.

To prevent the corn, which they provide in the ſummer for their ſupport in winter, from ſhooting or growing, they bite out the germen or bud before they lay it up; and that the moiſture of the earth may not occaſion it to ſwell and rot, they provide a dry earth or ſand to lay it in, and, when the ſun ſhines hot, frequently bring it out of their holes to dry and harden it.

As to ſummer proviſions, they take up with any thing that is eatable. You may ſee one loaded with the kernel of ſome fruit, another bending under the weight of a dead fly; and ſometimes ſeveral of them at work on a large ſubſtance, when what cannot be removed they eat on the ſpot, and carry home all that is capable of being preſerved.

But the whole ſociety is never permitted to make excurſions at random. Some are detached as ſpies to get intelligence; and, according to the tidings they bring, all the com-

munity (except ſuch as are appointed to guard the city, and take care of their young) are upon their march, either to attack a ripe pear, a cake of ſugar, or a treaſure of grain. And their expedition to it, as well as their return from it, is under ſome regulation; the whole band is ordered to aſſemble, and move in the ſame track: however, as they are a free people, theſe injunctions are never executed with much ſeverity; for if, by chance, they happen to ſpring new game, they are at liberty to leave the track, and ſeize upon it.

VEGETABLES.

Q. What do you mean by the Vegetable Kingdom?

A. Every thing that grows out of the earth, whether it be tree, plant, herb, or flower.

Q. Why is it called a kingdom?

A. That, as well as the doctrine of animals and minerals, are called kingdoms, becauſe as kingdoms contain a great number of people, ſo each of theſe general heads contains a variety of particulars. Every kingdom in natural hiſtory is divided into claſſes, orders, genera, ſpecies, and varieties. The kingdom contains ſeveral claſſes; each claſs ſeveral

orders; each order, ſeveral genera; each genus ſeveral ſpecies; and many ſpecies ſeveral varieties.

Q. What are the moſt remarkable vegeables?

A. The oak, the vine, the coffee tree, the tea tree, the tobacco plant, the ſugar cane, &c.

Q. What kind of tree is the oak?

A. It is one of the largeſt and moſt uſeful of all vegetables; it is the ſtrongeſt and moſt durable of all timber; and will continue firm and ſound, either in air or water, longer than any other wood. Hence the great value it is of to ſhip-builders, carpenters, and other architects. It is produced from the acorn, a ſmall fruit which it bears, very uſeful in feeding hogs and ſome other animals, and is ſaid by naturaliſts to grow three hundred years.

Q. What is a vine?

A. The vine is a plant or ſhrub of the reptile kind, ſupporting itſelf by creeping or climbing up any thing that ſtands near it. It is famous for its fruit, called grapes, which it produces in bunches, and from the juice of which is made wine.

The beſt ſituation for a vineyard is a dry ſoil, on the ſide of a hill fronting the ſouth; but generally the climate of England is too

cold to bring this fruit to the perfection neceſſary to afford wines with any thing like the flavour of thoſe produced in France, Spain, and Italy. There are various kinds of wine, which are generally denominated from the places where the vines grow. Thus Port comes from Portugal, Madeira from the iſlands of Madeira, and Burgundy and Champaign are the produce of thoſe provinces in France.

Q. What have you to ſay of the coffee-tree?

A. It is the tree that bears the coffee-berries. It grows very plentifully in Arabia, and is alſo cultivated in Turkey, and ſome parts of the Levant. The ſize of the berries is ſomething bigger than our largeſt peas, the flower is like the white jeſſamin flower, and the leaf like that of the bay.

The berries are of a pale colour, and imported to us as they are gathered from the tree; but, before they can be uſed to make the liquor which we call coffee, they are roaſted in tin boxes, till they become of a deep brown colour, and then ground in a mill to powder.

The cuſtom of drinking coffee is not of long ſtanding in England. Some ſay Dr. Hervey was the firſt who uſed it; others that one Paſqua, a Greek ſervant, brought into Eng-

land by Mr. Daniel Edwards, a Turkey merchant, in 1652, introduced it, and opened the firſt coffee-houſe in London.

Q. What have you to obſerve concerning the tea-tree?

A. The tea-tree grows in China, Japan, Siam, and other parts of the Eaſt Indies. It delights in valleys and a ſtony ſoil. That which is imported to us, and of which we make tea, are only the leaves. They are gathered by the natives in March and April, held over the ſteam of boiling water to moiſten them, and then laid on copper plates, and dried before the fire, which curls them in the manner we ſee.

The ſeed is uſually ſown in places expoſed to the ſouth, and the tree bears three years after ſowing. The root is ſomewhat like that of the peach tree; the leaves are about an inch and a half long, narrow at the point, and jagged all round. Its flower reſembles the wild roſe, which, when blown, is ſucceeded by a cod, not exceeding the ſize of a hazel nut, containing two or three ſeeds, from whence the plant is propagated. The tree is ſaid to be of various heights, even to an hundred feet or more.

Q. What are the chief properties of the tobacco plant?

A. The tobacco plant is cultivated in ſeveral parts of America; but the greateſt part of what is uſed in England is imported from the province of Virginia. It likewiſe grows in other parts of the world, in moſt of our iſlands in the Weſt Indies, and particularly in Tobago, whence it had its name. It is propagated from ſeed, which is ſown in pretty good ground, and for ſome time watered every day. In very hot weather it is protected from the fury of the ſun by branches of trees, or other things thrown over it.

When it is riſen to a certain height, they prepare a piece of ground for its reception, and tranſplant it much as we do lettuce; after which it is carefully weeded. The lower leaves are broken off, that they may not hang upon the ground and rot; and when it begins to ſhew its flower, the heads alſo are cut off, that only twelve or fifteen of the principal leaves, receiving all the nouriſhment, may grow larger, and of a thicker ſubſtance.

When ripe, the ſtalks are cut down, and hung up two by two under ſome ſhed or ſhelter from the ſun and rain, and dried by the air for fifteen or twenty days. When the leaves

are ſufficiently dried, they are pulled from the ſtalks, made up into bundles, which being wetted with ſea or common water, are twiſted into rolls, and in this manner imported into Europe, where the tobacconiſt with an engine cuts it for ſmoking, or grinds it for ſnuff, according to his occaſions.

This plant was firſt brought to England by Sir Walter Raleigh, in the reign of Queen Elizabeth, which gave occaſion, it is said, to the following curious incident:—One morning, while he was ſmoking a pipe of tobacco in his cloſet (a thing unknown to every body in England but himſelf), his ſervant entered with his breakfaſt, conſiſting of a tankard of ale and a toaſt, and obſerving Sir Walter ſurrounded with a cloud of ſmoke, imagined that by ſome unlucky accident he had caught fire; upon which he threw the tankard of ale in his face, and ran out of the room, exclaiming that his maſter was all in flames. Sir Walter was ſo well pleaſed with the humour of this adventure, that he readily forgave his ſervant.

Q. Is not the ſugar cane a very curious plant?

A. It certainly is: it is produced in many parts of the Weſt Indies, particularly the Caribbee Iſlands, as Barbadoes, Jamaica, St.

Chriſtopher's, &c. It uſually grows five or ſix feet high, and is about half an inch in diameter. The ſtem, or ſtalk, is divided by knots a foot and a half apart. At the top it puts forth a number of long green leaves, from the middle of which ariſe the flower and the ſeed. When ripe, which is commonly in about ten months, it is found quite full of a white juicy pith, from which is expreſſed the liquor whereof ſugar is made.

The proceſs of ſugar is as follows: after the canes are cut, they are carried in bundles to the mills, which conſiſt of three wooden rollers, covered with ſteel plates, and are wrought by water, or wind, or cattle, or ſlaves. The liquor, when the canes are broken and preſſed between the rollers, runs through a little canal into the ſugar houſe, and is conveyed into a copper heated by a ſlow fire, juſt to make it ſimmer, where it receives its firſt ſeparation. With the liquor is here mixed a quantity of aſhes and quick lime; the effect of which mixture, aſſiſted by the action of fire, is, that the unctuous parts are ſeparated from the reſt, and raiſed to the top in form of a thick ſcum, which is conſtantly taken off with a ſkimmer.

This done, it is further purified in a ſecond, third, fourth, and fifth boiler, in which laſt

it is brought to the confiftence of a fyrup. Then in the fixth boiler the fyrup receives its full coction: and here all the impurities left by the former lees are taken away by a new lee, and a water of lime and allum is caft into it.

In this laft copper there is fcarcely found one-third of what was in the firft, the reft being wafted in fcum. By thus paffing a number of coppers, the fugar juice is purified, thickened, and rendered fit to be converted into any kind of fugar?

Q. Are there not many ufeful and curious trees and plants befides thofe you have mentioned?

A. Moft certainly: the cabbage-tree anfwers moft of the purpofes of garden-ftuff; the bread fruit tree, lately found in fome of the newly difcovered iflands in the South Sea, and happily, after various attempts, tranfplanted into the Weft-India iflands, furnifhes an eatable that is no bad fuccedaneum for bread made of grain: and the fir-tree produces pitch and tar, without which fhips could not be properly built, at leaft not finifhed. The fun-flower is a moft curious plant, that points its face towards the fun, whichever way he turns.

MINERALS.

Q. What do you mean by minerals?

A. Every thing dug out of the bowels of the earth.

Q. Are not theſe very numerous?

A. Certainly; and to talk of them all would not only be endleſs, but foreign to our preſent purpoſe. It will be more conſiſtent with our deſign to make a few remarks upon metals which are better known and more uſeful.

Q. Which are the moſt common kinds of metals?

A. Gold, ſilver, copper, iron, lead, and tin; to which ſome add mercury.

Q. What have you to ſay of gold?

A. Gold is the heavieſt, pureſt, and moſt ductile of all metals. It is chiefly found in mines, though ſometimes gold-duſt is found in the ſand and mud of rivers, particularly in Guinea; and hence the name of our largeſt gold coin. There are gold-mines in moſt countries in the world, though in Europe they are very ſparingly ſcattered. The mines of Chili and Peru in America are the richeſt, though very fine gold is found in ſome parts of the Eaſt Indies.

Of all the properties of gold, its ductility is the moſt ſurpriſing. A ſingle ounce of gold may be entended by the gold-beater's hammer to a ſurface of nearly 150 ſquare feet, but by the gold wire drawers it will be extended to upwards of a thouſand, and yet remain ſo entire, as that the leaſt flaw ſhall not be perceived, even by the help of the microſcope.

In gold mines, another metal called *platina* is often found, which is the heavieſt of all metals, and much harder than gold or ſilver.

Q. What have you to obſerve with regard to ſilver?

A. Silver is a rich white metal, and, except gold, the fineſt and moſt ductile of any. There are ſilver mines in all parts of the world; but thoſe of Peru, and ſome other parts of America, particularly thoſe of Potoſi, are by far the richeſt, and yield the ore in as great plenty as when firſt diſcovered; with this only difference, that the veins, which were then almoſt on the ſurface of that famous mountain, are now ſunk ſo deep, that the workmen go down to them by a deſcent of four or five hundred ſteps.

Q. What kind of ſubſtance is copper?

A. It is a hard, dry, heavy, ductile metal, abounding in vitriol and ſulphur, and found

in moſt parts of Europe, but particularly in Sweden. It is dug up in large fragments of ore, which are firſt beaten ſmall, then waſhed to ſeparate the earthy parts from it, then ſmelted and caſt into a kind of moulds to form large blocks, called ſalmons, or copper-cakes. There is the ordinary copper; a finer kind, called roſe copper; and a ſtill finer, called virgin copper, which is ſometimes found pure in mines. A mixture of copper and tin forms bronze; two parts of copper, and one of zinc, forms braſs; in different proportions it makes the prince's metal.

Q. What kind of ſubſtance is iron?

A. Iron is a hard, dry, fuſible, and ductile metal, conſiſting of earth, ſalt, and ſulphur, but all impure, ill mixed, and ill digeſted, which renders it liable to ruſt. By often heating it in the fire, hammering it, and letting it cool of itſelf, it is ſoftened; by extinguiſhing it while hot in water, it is hardened. There are a great number of iron-works in England; but ſome of the moſt conſiderable are thoſe in the foreſt of Dean, in Glouceſterſhire, where the ore is found in great abundance. Though iron is the cheapeſt, it is certainly the moſt uſeful

of all kinds of metal, and ſeems indiſpenſably neceſſary to the carrying on every art and manufacture. Nay, it appears to be the great means of poliſhing and civilizing mankind; at leaſt much more ſo than the more precious metals. There have been inſtances of nations poſſeſſed of great quantities of gold, and who yet remained in a ſtate of barbariſm; this, it is well known, was the caſe with the Americans upon the firſt diſcovery of their country by Columbus: but there never yet was an inſtance of a nation, who underſtood the art of making, or manufacturing of iron, but what attained, in time, to a conſiderable degree of civilization.

Q. What is ſteel?

A. If iron be placed in contact with red hot charcoal, or any other carbonaceous ſubſtance, for ſome time, it becomes much harder, and elaſtic, and is called ſteel.

Q. What kind of ſubſtance is lead?

A. Lead is a ſoft, heavy, coarſe metal, containing a little mercury, ſome ſulphur, and a great deal of earth. It is found in moſt countries; but is particularly plentiful in

England. The various purpofes to which it may be applied are pretty generally known.

Q. What is tin?

A. It is a whitifh metal, not fo hard as filver, nor fo foft as lead; but though not fo foft, is yet more eafily melted. The ftannaries or tin mines in Cornwall and Devonfhire furnifh the greateft part of the tin that is confumed in all Europe.—Six pounds of brafs, and fifteen pounds of lead, to an hundred pounds of tin, make the compofition called pewter.

Thin fheets of iron, coated with tin, make that compofition which is called *b.ock tin*, which is now in fuch common ufe.

Tin is employed in the compofition of printers' types. It is ufed as tin-foil in electrical apparatus, in tinning iron and copper, and in filvering mirrors.

Q. What is mercury?

A. Mercury, or, as it is commonly called, quickfilver, is an imperfect metal, neither ductile nor malleable, that is, neither capable of being drawn into length, nor fpread into breadth by the hammer. It confifts entirely of a fluid matter, refembling melted filver. It is found chiefly in Hungary, Spain, Italy, and

Peru. The greateſt part of what is uſed in England is brought from the mines of Friuli in Italy.

The chief properties of mercury are, that, except platina and gold, it is the heavieſt of all metals. It is alſo the moſt fluid of all bodies; that is, its parts cohere the leaſt to each other, and are the moſt eaſily ſeparated. It is extremely volatile, and may be turned into fume by a very gentle heat. It eaſily enters, and cloſely adheres to gold, leſs eaſily to ſilver, with difficulty to copper, and to iron not at all.

The weight of a cubic inch of each of the following metals, viz. gold, mercury, lead, ſilver, copper, iron, and tin, is as follows:

	Oz.	Dr.	Gr.
Gold - - -	12	2	52
Mercury - -	8	6	8
Lead - - -	7	3	30
Silver - - -	6	5	28
Copper - - -	5	6	36
Iron - - -	5	1	24
Tin - - -	4	6	17

Q. Are there not many other things contained in the bowels of the earth beſides thoſe you have mentioned?

A. Yes. 1. There are vaſt quarries of ſtone and marble, ſo uſeful in building. 2. There are mines of coal, ſo neceſſary to human life, particularly in thoſe cold countries, where only they are found. And 3. There are various beds of clay, which ſerve the potter's uſe, the fuller's, or the brickmaker's. But there are two remarkable bodies that deſerve a more particular attention; and theſe are, the diamond and the loadſtone.

Q. What is the diamond?

A. The diamond, by the ancients called adamant, is the moſt valuable of all precious ſtones. Its goodneſs conſiſts in its water or colour, luſtre, and weight; and its defects are flaws, veins, ſpecks of red and black ſand, and a blueiſh or yellowiſh caſt.

The diamond is found only in the Eaſt Indies, ſometimes in mines, and ſometimes in the ſand of rivers. It is the hardeſt of all gems, inſomuch that it can only be cut and ground by itſelf, and its own ſubſtance.

The manner of preparing diamonds is firſt to rub them hard againſt each other, and the duſt which is thus rubbed off the ſtones ſerves to grind and poliſh them; and this is done by means of a mill, which turns a wheel of ſoft

iron, ſprinkled over with diamond duſt mixed with oil of olives. The ſame duſt, well ground, and diluted with water and vinegar, is uſed in the ſawing of diamonds; which is performed with an iron or braſs wire, as fine as hair.

There are many other precious ſtones, and I will give you the names and colours of ſome of the principal. The ruby, which is next in value and eſteem to the diamond; it is of a crimſon colour, inclining to a purple. The garnet is ſomewhat like it, and perhaps of the ſame ſpecies. The hyacinth is ſometimes of a deep red, and ſometimes of a yellow colour. The amethyſt is of a bright purple. The emerald, a graſs green. The beryl, a ſea or blueiſh green. The ſapphire, a ſky blue. The topaz, or chryſolite, is of a gold colour. Theſe are all tranſparent.

There are others that are opaque, or only half tranſparent; ſuch as the cornelian, which is the beſt; and of a pale red, ſometimes bordering upon orange; the onyx, of a greyiſh caſt; the turquoiſe, ſomething between a blue and green; and the lapis lazuli, which is ſtudded with ſpots of gold on an azure ground.

Q. What is the magnet or loadſtone?

A. This wonderful ſtone is uſually found in

iron mines, and is produced in moſt parts of the world; in China, Bengal, Arabia, Hungary, Germany, and England. It is a heavy ſtone, ſomething reſembling the ore of iron, only cloſer and more ponderous.

It is endowed with ſome ſurpriſing qualities and powers. It attracts iron, which will adhere to it very ſtrongly; and this virtue it alſo communicates to the iron ſo attracted. In every magnet there are two poles, one of which points northwards, the other ſouthwards; and if the magnet be divided into ever ſo many pieces, the two poles will be found in each piece.

It is this property which has rendered it ſo uſeful in improving the art of navigation: for it gave riſe to the mariner's compaſs, by means of which a ſailor can now conduct his ſhip to the Eaſt or Weſt Indies, or even round the world, with as much eaſe and as little danger as he could formerly make a voyage from England to the coast of Norway or Holland.

Q. Have the improvements in ſhip-building kept pace with thoſe of navigation?

A. They no doubt have. To be convinced of this one need only conſider the infinite

difference there is between a firſt-rate man of war and an Indian canoe; and yet this was probably the firſt form of all ſailing veſſels.

Even after men had learned to build ſhips with more art and of a larger ſize, they never ventured out of ſight of land without fear and trembling, becauſe they could not tell whether they were ſailing eaſt or weſt, ſouth or north, or to what part of the world they were going; but now, in the darkeſt night, and in the midſt of the boundleſs ocean, they know the courſe they are ſteering with as much certainty as if it were in broad day, and within ſight of land.

SEQUEL OF PHYSICS;

OR,

NATURAL PHILOSOPHY.

Of Sound.

Q. You ſaid, that ſound moves 1142 feet in a ſecond. Pray, can you tell how far ſounds may be heard?

A. This is a matter not altogether certain: but there are ſome ſounds (as the exploſions of great guns, &c.) which have been heard at the diſtance of 180 or 200 miles.

Q. Can you give any inſtance of this?

A. Derham, in his Phyſico-Theology, ſays, that guns fired at Stockholm, in 1685, were heard at the diſtance of 180 Engliſh miles; and in the ſea-fight between England and Holland, in 1672, the noiſe of the guns was heard even in Wales, which cannot be leſs than 200 miles.

Q. May not a low or languid ſound be ſometimes heard at a great diſtance?

A. It certainly may, as any one may ſatisfy himſelf by making the experiment in the whiſpering gallery of St. Paul's. Nay, it may be even heard ſo in the open air. Mr. Clare ſays, a gentleman of great veracity, who had lived ſome years at Gibraltar, aſſured him, that he has, at Old Gibraltar, heard the watch-word of the night (viz. *All's Well*) given by the centinel to the patrole on the ramparts of New Gibraltar, in a ſtill ſerene night, and that as plainly and diſtinctly as he ſhould have done had he been on the rampart himſelf. The bay between theſe two places is ſuppoſed to be about ten miles and a half in length.

Q. Does not the wind greatly obſtruct the motion of ſounds?

A. Not ſo much as might be expected; though there is a ſmall difference in the velocity of ſound, according as it moves with or againſt the wind.

Q. How do you eſtimate the ſtrength or intenſity of ſound?

A. That is always as the ſpace paſſed through by the particles of undulating air, in their paſſive motion backward and forward. In a warm and rarefied air, the ſtrength or intenſity of ſounds is not ſo conſiderable as in a cold and denſer air, when the elaſticity of

it is greater. The velocity of ſound is 52 times greater than that of a briſk wind.

Q. Have you any thing elſe to ſay concerning the motion of ſounds?

A. Sounds paſs through equal ſpaces in equal times, and nothing but the wind can accelerate or retard them. They are not in the leaſt affected by the difference of day or night, of ſummer or winter, of heat or cold.

Q. Pray, Sir, what is the nature of that ſingular ſound we ſometimes hear, and which we diſtinguiſh by the name of echo?

A. An echo is no more than the reverberation or reflection of a ſound from the ſurface of ſome hard and ſmooth body, ſuch as a wall, rock, &c. whence flying back, it re-ſalutes our ears with the ſame ſound.

Q. Can you mention any remarkable echoes?

A. Dr. Plot, in his natural hiſtory of Oxfordſhire, ſays, that the famous echo in Woodſtock Park returned 17 ſyllables in the daytime, when the wind was a little ſtirring, and 20 in the night time; for then the air being denſer, the vibrations became ſlower, and ſo a repetition of more ſyllables was heard. And Dr. Harris, in his Technical Dictionary, aſſures us, that there is a much finer echo from

the north ſide of Stepney church, in Suſſex, which, in the night-time, would repeat theſe 21 ſyllables:—

Os homini ſublime dedit, cœlumque tueri
Juſſit, et erectos———

Of Colours.

Q. How many colours are there?

A. There are no more than ſeven original ones.

Q. What are they?

A. 1. Red.—2. Orange.—3. Yellow.—4. Green.—5. Blue.—6. Indigo.—7. Violet.

Q. How are the different colours diſcovered?

A. By the different degrees with which the ſeveral rays are refrangible.

Q. What do you mean by the refrangibility of the rays of light?

A. I mean their tendency to be turned out of a ſtraight line, or to be rendered crooked, in paſſing through any medium, as a glaſs priſm.

Q. Which are the leaſt refrangible rays?

A. Thoſe that produce the red colour.

Q. Which are the moſt refrangible?

A. Thoſe that produce the violet. And all the intermediate rays produce the intermediate colours in the order above-mentioned.

Q. It ſhould ſeem, from what you have ſaid, that colours are only in the rays of light that produce them, and not in the bodies that are dyed with them. Is that your meaning?

A. It certainly is.

Q. Strange doctrine indeed! I am afraid you will get few people to be of your opinion.

A. I cannot help whether they be of my opinion or not; I know it is well founded: and that it is you may eaſily ſatisfy yourſelf, by obſerving, that all bodies are of the ſame hue in the dark.

Q. If it be abſolutely dark, we cannot ſee at all.

A. True: but there ſurely may be ſomething between an obſcure light and abſolute darkneſs, juſt ſufficient to ſhew us, that a man has got a coat upon his back, though we cannot tell for certain of what colour it is.

Q. But are black and white no colours?

A. No; they are no original colours; white is a mixture of all theſe colours; black a privation of them all, or no colour at all.

Of the Air.

Q. What other properties does the air poſſeſs beſides thoſe you have already mentioned?

A. 1. The air may be rarefied and condenſed. 2. It is endued with an elaſtic power or force. 3. It hath weight or gravity. 4. It hath proper bounds or limits, and is not infinite. And 5. It is neceſſary to the life of animals, and the growth of vegetables, and to many other things.

Q. How does it appear that the air may be rarefied?

A. Thus:—If you take a bladder, entirely empty, as you think, and tie its neck with a ſtring, and lay it before the fire, the heat will ſo rarefy the little air incloſed in it as to make it extend the bladder to its utmoſt ſtretch, and, if continued, will burſt it, with a report like that of a gun.

That the air may be condenſed, even to a ſixtieth part of the ſpace it before occupied, is proved by a variety of experiments.

Q. How can you ſhew the air's elaſticity?

A. By experiments with the air-pump, and otherwiſe. One very ſimple one is this:—an empty bladder, whoſe neck is tied faſt, being

put into the receiver, and the external air contained in it exhaufted, the fmall quantity of air inclofed in the bladder will, by its own proper fpring or elaftic force, gradually expand itfelf, and will at laft fo extend the bladder as to break it.

Thus alfo, the air compreffed in the wind-gun will, by its elaftic force when difcharged, drive a bullet through a board at the diftance of feveral yards, in the fame manner as if it were with gun-powder.

Nay, Mr. Boyle found, that air, by its elafticity, would fo far dilate or expand itfelf, as to take up 13,769 times more fpace than before?

Q. How do you prove the weight or gravity of the air.

A. By experiments with the air-pump, barometer, &c. The weight of the air is greater the nearer it is to the furface of the earth. The mercury in the barometer, by the preffure of the air, is raifed to the height of 28, 29, 30, or 31 inches; therefore fuch a column of mercury is equal in weight to a column of air (of an equal bafe), which rifes from the fame level as the mercury at the bottom of the barometer, to the uppermoft part of the atmofphere. Moreover, fince mercury is about fourteen times heavier than

water, water will riſe in a tube to 32 or 33 feet in height; and therefore every ſquare foot in any ſuperfices ſuſtains the weight of a column of water of 32 or 33 ſolid feet. Now a cubic foot of water weighs about 63 pounds; and hence it follows, that the weight of air on every ſuperficial ſquare foot is above 2000 pounds.

Q. May not many curious inferences be drawn from thence?

A. Certainly; here is one: Suppoſe the ſurface of a man's body to be about 14 ſquare feet, then the weight of the air preſſing upon him is equal to 28,000 pounds, or 250 hundred weight; that is, twelve tons and a half.

Q. This is very ſurpriſing. But if men,—and, I ſuppoſe, the caſe is the ſame with all other animals, and indeed with all bodies whatever,—are preſſed by ſo great a weight, how comes it that they are not cruſhed to pieces?

A. They are preſerved by the re-action of the internal air, or the air within them, which maintains a kind of balance or equilibrium.

Q. Are animals ſenſible of this preſſure of the air upon them?

A. No: on the contrary, they would be extremely ſenſible of the want of it, were it

withdrawn from them. In that cafe, indeed, they could neither breathe, nor even live, but would very foon die, as is evident from the experiments performed by the air-pump.

Q. What is the air-pump?

A. It is a curious machine for extracting the air from a large hollow glafs, called a receiver, fomewhat refembling thofe glaffes that are ufed in gardens for covering tender plants. Into this glafs if any animal is put, and the air drawn from it, it will almoft immediately die.

Q. Do all animals die in the air-pump in the fame fpace of time?

A. Not exactly. Some die fooner and fome later, either according to the ftrength of the vital principle within them, or according as they have been accuftomed to live with more or lefs air. Dogs, cats, rats, and mice die in about half a minute; a mole dies in one minute; infects, fuch as wafps, bees, hornets, and grafshoppers, appear dead in two minutes, and will continue in that ftate a whole day and night, and afterwards revive upon the re-admiffion of the air; ear-wigs, beetles, and fnails, live a long time without air.

Q. It certainly muft be curious to obferve thefe artificial deaths and refurrections. But

is it not cruel thus to put animals to death merely for the ſake of experiments?

A. It no doubt is; and therefore philoſophers have invented a machine, called the lungs-glaſs, which anſwers almoſt the ſame purpoſes.

Q. What elſe have you to ſay of the air-pump?

A. In the exhauſted receiver of an air-pump all bodies fall with the ſame rapidity: a feather falls as faſt as a guinea; that is, the lighteſt of all bodies falls as faſt as the heavieſt.

Q. May not many other curious experiments be performed by the air-pump?

A. Certainly; here follow a few of them:

1. Put a ſhrivelled apple under a cloſe receiver, and exhauſt the air; then the ſpring of the air within the apple will plump it out, ſo as to make all the wrinkles diſappear; but upon letting the air into the receiver again, to preſs upon the apple, it will inſtantly return to its former decayed and ſhrivelled ſtate.

2. Take a freſh egg, and cut off a little of the ſhell and film from the ſmalleſt end, then put the egg under the receiver, and pump out the air; upon this all the contents of the egg will be forced out into the receiver, by the expanſion of a ſmall bubble of air contained in the great end between the ſhell and film.

3. Set a bell upon a cuſhion on the pump plate, and cover it with a receiver; then ſhake the pump to make the clapper ſtrike againſt the bell, and the ſound will be very well heard. But exhauſt the air out of the receiver, and then if the clapper be made to ſtrike ever ſo hard againſt the bell, it will make no ſound at all; which ſhews, that air is abſolutely neceſſary for the propagation of ſound.

Q. Have you any thing elſe to ſay concerning the nature of air?

A. The elaſtic air which is contained in many bodies, and is kept in them by the weight of the atmoſphere, may be got out of them either by boiling, or by the air-pump; but the fixed air, which is by much the greater quantity, cannot be got out but by diſtillation, fermentation, or putrefaction.

Q. What would you infer from hence?

A. What I would infer from it is, that this is a very wiſe law of Providence; for if fixed air did not come out of bodies with difficulty, and ſpend ſome time in extricating itſelf from them, it would tear them to pieces. Trees would be rent by a change of air from a fixed to an elaſtic ſtate, and animals would be burſt to pieces by the exploſion of air in their food.

Q. How does this appear?

A. Dr. Hales, found, by experiment, that the air in apples is ſo much condenſed, that if it were let out into the common air, it would fill a ſpace 48 times as great as the apples themſelves; ſo that its preſſure outward was equal to 11,776 pounds, and, in a cubic inch of oak, to 19,860 pounds, againſt its ſides.

If, therefore, the air were let looſe at once in theſe ſubſtances, they would tear every thing to pieces about them with a force ſuperior to that of gun-powder. Hence, in eating apples, it is well that they part with the air by degrees, as they are chewed, and ferment in the ſtomach, otherwiſe an apple would be immediate death to him that eats it.

Q. What other properties of air can you mention?

A. The common air which we breathe is compoſed of two kinds, one of which, called vital air, is that which ſupports life. In one gallon of common about one-third is vital, which is ſufficient to ſupport an human being about a minute?

Q. How do you know that a man will conſume the pure part of a gallon of air in a minute?

A. By the diving-bell, in which, if a man

defcend into the deep, he can only live as many minutes as the number of gallons of air contained in the bell amount to. Even a burning candle confumes the pure part of a gallon of air in a minute.

Q. How does this appear?

A. By the following experiment:—Set a lighted candle upon the air-pump, or indeed upon any other place fo fmooth, that, when covered with a receiver, no air can enter. If the receiver holds a gallon, the candle will burn a minute; and then, after having gradually decayed from the firft inftant, it will go out; which fhews, that a conftant fupply of frefh air is as neceffary to feed flame, as it is to fupport the lives of animals.

Q. May not this pure part of air be deftroyed?

A. Certainly; and that too in a variety of ways. Firft, by paffing through the lungs of animals, as is evident from what we have juft now faid. Secondly, by paffing through fire, particularly charcoal fire, or the flame of fulphur. Hence fmoky chimnies muft be very unwholefome, efpecially if the rooms they are in be fmall and clofe. Thirdly, by being long pent up in any clofe place, fuch as the holds of fhips, oil-cifterns, or wine-cellars. The

air in many of theſe is ſometimes ſo corrupted, as to cause inſtant death to any animal that comes into it.

Q. Does not this air go by a particular name?

A. It is called *Choke-Damp*; not only becauſe it is filled with humid or moiſt vapours, but becauſe it deadens fire, extinguiſhes flame, and deſtroys life. The dreadful effects of theſe damps are ſufficiently known to thoſe who work in mines.

Q. May not the air be greatly condenſed?

A. It may be ſo much condenſed in what is commonly called the air-gun, that it will throw out a ball with almoſt as much force as if it were done with gun-powder.

Q. Is there not another kind of air-gun that will produce ſtill more ſurpriſing effects?

A. Yes; there is a gun, called the magazine air-gun, in which the air may be ſo condenſed, as to make it ſhoot a number of balls, one after another, with incredible force.

Q. May not the air be rarefied as well as condenſed?

A. Yes; and the rarefaction of it gives riſe to many ſingular phœnomena. The rarefaction of it in the atmoſphere produces wind;

and the rarefaction of it in the bowels of the earth is ſuppoſed to be the cauſe of earthquakes.

Q. Is it not poſſible to make an artificial earthquake?

A. An artificial earthquake may be made thus: Take 10 or 15 pounds of ſulphur, and as much of the filings of iron, and knead them with common water into the conſiſtency of a paſte. This being buried in the ground, will, in 8 or 10 hours time, burſt out into flames, and cauſe the earth to tremble all around to a conſiderable diſtance.

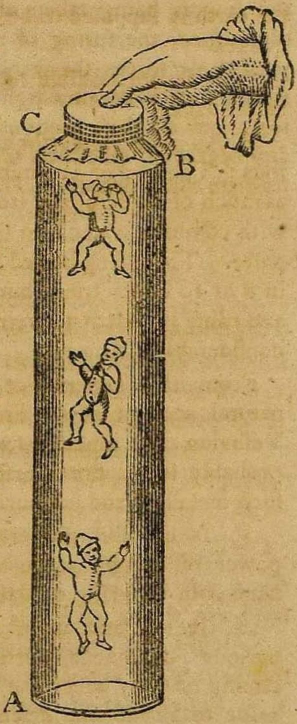
From this experiment we have a very natural account of the fires of mount Ætna, Veſuvius, and other volcanoes, they being probably ſet on fire at firſt by the mixture of ſuch metalline and ſulphurious particles.

Q. Is not this property of air, viz. its power of being rarefied and condenſed, the ſame with its ſpring or elaſticity?

A. It is; and upon this depend many curious phenomena, particularly that entertaining one, by which the little glaſs men are made to aſcend and deſcend, at the word of command, in a glaſs tube of water.

Q. How is this experiment performed?

A. The men being blowed hollow, are thereby rendered lighter than water, and will ſwim in it; and having a ſmall hole in one foot, and a bladder tied over the top of the tube, as C B, if this be preſſed with the fingers, the included air, by its ſpring, will equally preſs the water, which will enter the feet of the men, and compreſs the air in them, and thereby render them heavier in any degree. If they are by this means brought to the ſame gravity with the water, they will abide in any ſituation you pleaſe. If they are rendered heavier by



preſſing the bladder harder, they will deſcend; the fingers being taken off, or the preſſure diminiſhed, the ſpring of the included compreſſed air forces the water out of the men, which thus becoming lighter, aſcend to the top; and all theſe motions may be varied in any degree of quickneſs or ſlowneſs the performers think proper.

OF

WATER AND WATER ENGINES;

COMMONLY CALLED

HYDRUALIC MACHINES.

Q. What is water?

A. It is a fluid, as well as air (all its parts yielding eaſily to the ſlighteſt preſſure), only it is of a more heavy and compact body.

Q. How high will water riſe in a pump?

A. It will riſe to the height of 32 or 33 feet, and no higher, unleſs it be driven up by a forcing engine.

Q. What is the reaſon of this?

A. The reaſon of it is, that the water without the pump is preſſed upon by the whole weight of the air above it; and it has been found by experiment, that the weight of a column of air from the top of the atmoſphere to the earth, is equal to the weight of a column of water of the ſame diameter, 32 or 33 feet high.

Q. Well; but how does this affect the water in the pump?

A. It would not affect it at all, were not the air drawn out of the pump by means of the piston; and then the water rises in the pump, to preserve an equilibrium.

Q. I think I have heard it said, that water may be conveyed in pipes over hills and vallies to any distance: may it really be so?

A. It certainly may; but then it must be observed, that the water will never rise higher than the head of the fountain from which it comes; nor indeed so high by some feet.

Q. I have likewise heard it said, that wood may be made to lie at the bottom of the water, as if it were a stone. Is that possible?

A. It is very possible.

Q. How is it done?

A. Let two pieces of wood be planed so smooth as that no water can get between them when they are put together. Cement one of them to the bottom of the tub; lay the other piece upon it, and hold it down with a stick, while you pour water into the tub till it is full. Then take away the stick, and you will see the upper piece of wood remain glued as it were to the under piece, though it is kept down by nothing but the pressure of the water above it. But if once the water get between the two pieces of wood, the upper piece will immediately ascend, and swim on the surface.

Q. That is very ſtrange.

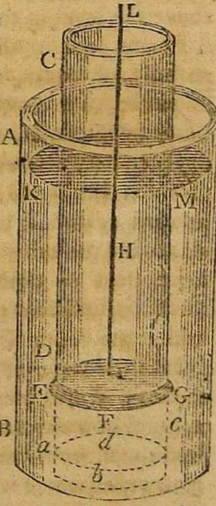
A. It no doubt is; but you will think it ſtill more ſtrange when I tell you, that as wood may be made to lie at the bottom of water as if it were a ſtone, ſo lead may be made to ſwim in water as if it were a piece of wood.

Q. That, I think, is impoſſible.

A. And yet, that it is poſſible, you may eaſily be ſatisfied by making the experiment yourſelf.

Q. How ſhall I make it?

A. Thus. Let C D be a glaſs tube, open at both ends, and E F G a flat piece of lead, exactly fitted to the lower end of the tube, not to go within it, but for it to ſtand upon; with a wet leather between the lead and the tube, to make cloſe work. Let this leaden bottom be half an inch thick, and held cloſe to the tube by pulling the pack-thread I H L upward at L with one hand, whilſt the tube is held in the other by the upper end C. In this ſituation let the tube



be immerſed in water in the glaſs veſſel A B to the depth of ſix inches below the ſurface of the water at K; and then the leaden bottom E F G will be plunged to the depth of ſomewhat more than eleven times its own thickneſs: holding the tube at that depth, you may let go the thread at L, and the lead will not fall from the tube, but will be kept to it by the upward preſſure of the water below it (for water preſſes upward as well as downward), occaſioned by the height of the water at K above the level of the lead.

For as lead is about 11 times as heavy as its bulk of water, and is in this experiment immerſed to a depth ſomewhat more than 11 times its thickneſs, and no water getting into the tube between it and the lead, the column of water E *a b c* G below the lead is preſſed upward againſt it by the water K D E G L all around the tube; which water being a little more than 11 times as high as the lead is thick, is ſufficient to balance and ſupport the lead at the depth K E.

If a little water be poured into the tube upon the lead, it will increaſe the weight upon the column of water under the lead, and cauſe the lead to fall from the tube to the bottom of the glaſs veſſel, where it will be in the ſituation *b d*.

Or, if the tube be raiſed a little in the water, the lead will fall by its own weight, which will then be too great for the preſſure of the water around the tube upon the column of water below it.

Q. I have heard a great deal of the ſyphon as being a very curious machine.

A. It is not only very curious, but likewiſe extremely uſeful to all people that deal in wine, or other liquors.

Q. I ſhould be glad to have ſome ſhort account of it.

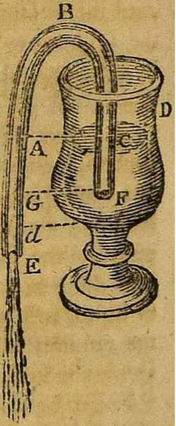
A. Here follows a very brief one. A ſyphon, generally uſed for decanting liquors, is a bended pipe, whoſe legs are of unequal lengths; and the ſhorteſt leg muſt be always put into the liquor intended to be decanted, that the perpendicular height of the column of liquor in the other leg may be longer than the column in the immerſed leg, eſpecially above the ſurface of the water.

For if both columns were equally high in that reſpect, the atmoſphere, which preſſes as much upward as downward, and therefore acts as much upward againſt the column in the leg that hangs without the veſſel, as it acts downward upon the ſurface of the liquor in the veſſel, would hinder the running of the

liquor through the ſyphon, even though it were brought over the bended part by ſuction. So that there is nothing left to cauſe the motion of the liquor, but the ſuperior weight of the column in the longer leg, on account of its having the greater perpendicular height.

Q. I ſhould be glad to have this illuſtrated by a figure.

A. Here then I preſent you with one. Let D be a cup filled with water to C, and A B C a ſyphon, whoſe ſhorter leg B C F is immerſed in the water from C to F. If the end of the other leg were no lower than the line A C, which is level with the ſurface of the water, the ſyphon would not run, even though the air ſhould be drawn out of it at the mouth A. For although the ſuction would draw ſome water at firſt, yet the water would ſtop at the moment the ſuction ceaſed. becauſe the air would act as much upward againſt the water at A, as it acted downward upon it by preſſing on the ſurface at C.



But if the leg A B come down to C, and

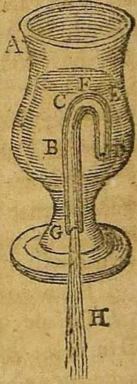
the air be drawn out at G by ſuction, the water will immediately follow, and continue to run, until the ſurface of the water in the cup comes down to F; becauſe, till then, the perpendicular height of the column B A G will be greater than that of the column C B; and conſequently its weight will be greater until the ſurface comes down to F; and then the ſyphon will ſtop, though the leg C F ſhould reach to the bottom of the cup. For which reaſon the leg, that hangs without the cup, is always made long enough to reach below the level of its bottom; as from *d* to E: and then, when the ſyphon is emptied of air by ſuction at E, the water immediately follows, and by its continuity brings away the whole from the cup; juſt as pulling one end of a thread will make the whole clue follow.

If the perpendicular height of a ſyphon from the ſurface of the water to the bended top at B be more than 33 feet, it will draw no water, even though the other leg were much longer, and the ſyphon quite emptied of air; becauſe the weight of a column of water 33 feet high is equal to the weight of as thick a column of air, reaching from the ſurface of the earth to the top of the atmoſphere; ſo that there will then be an equilibrium, and conſequently,

though there would be weight enough of air upon the ſurface C to make the water aſcend in the leg C B almoſt to the height B, if the ſyphon were emptied of air, yet that weight would not be ſufficient to force the water over the bend; and therefore it could never be brought over into the leg B A G.

Q. Is there not a kind of ſyphon called *Tantalus's* cup?

A. Yes, and it is formed thus. Let a hole be made quite through the bottom of the cup A, and the longer leg of the bended ſyphon D E B G be cemented in the hole, ſo that the end D of the ſhorter leg D E may almoſt touch the bottom of the cup within.—Then, if water be poured into this cup, it will riſe in the ſhorter leg by its upward preſſure, driving out the air all the way before it through the longer leg; and when the cup is filled above the bend of the ſyphon at F, the preſſure of the water in the cup will force it over the bend of the ſyphon; and it will deſcend into the longer leg C B G, and run through the bottom, until the cup be emptied.



In order to make the figure the more ſtriking, a little hollow ſtatue or figure of a man is ſometimes put over the ſyphon to conceal it; the bend E being within the neck of the figure as high as the chin. So that poor *Tantalus* ſtands up to the chin in water, imagining it will riſe a little higher, that he may drink; but inſtead of that, when the water comes up to his chin, it immediately begins to deſcend, and, as he cannot ſtoop to follow it, he is left as much pained with thirſt as ever.

Q. Do bodies weigh equally in air and in water?

A. No; they weigh much heavier in the former than they do in the latter, and it is by weighing them in theſe two different mediums that we find out their weight bulk for bulk, or what is commonly called ſpecific gravity.

Q. How was this art firſt invented?

A. By the following curious incident:—Hiero, king of Syracuſe, having employed a goldſmith to make a crown, and given him a maſs of pure gold for that purpoſe, ſuſpected that the workman had kept back a part of the gold for his own uſe, and made up the weight by alloying the crown with copper. But not knowing how to find out the cheat, if

there was any, he referred the matter to Archimedes; who having ſtudied a long time in vain, at laſt found it out in the following manner:—

One day, upon his going into a bathing tub of water, he obſerved, that he thereby raiſed the water higher in the tub than it was before. From this he concluded, that he raiſed the water juſt as high as any thing elſe of the ſame bulk with himſelf would have done; but not ſo high as another body of equal weight, and larger bulk, would have raiſed it. He then went to the king, and told him that he had found out a method by which he could diſcover the deceit of the goldſmith, if he had been guilty of any.

For, ſince gold is the heavieſt of all metals, it muſt be of leſs bulk, according to its weight, than any other metal. And therefore he deſired, that a maſs of pure gold, equally heavy with the crown, when weighed in air, ſhould be weighed againſt it in water; and if the crown was not alloyed, it would counterpoiſe the maſs of gold when they were both immerſed in water, as well as it did when they were weighed in air.

But, upon making the trial, he found that the maſs of gold weighed much heavier than

the crown did. And not only ſo, but that when the maſs and crown were immerſed ſeparately in the ſame veſſel of water, the crown raiſed the water much higher than the maſs did; which ſhewed it to be alloyed with ſome lighter metal that increaſed its bulk. And ſo, by making trials with different metals, all equally heavy with the crown when weighed in air, he found out the quantity of alloy in the crown.

ADDITIONAL REMARKS

ON

GEOGRAPHY.

Q. Are there not many curious things in Geography, at leaſt in the ſcientific part of it, beſides thoſe you have mentioned.

A. There certainly are.

Q. What are they ?

A. To mention them all would exceed the limits of this ſhort Appendix. I ſhall content myſelf at preſent with pointing out a few of the moſt remarkable.

Q. What are theſe ?

A. It is certainly very remarkable, that though the earth be nearer the ſun in winter than it is in ſummer, it is yet much colder in the former of theſe ſeaſons than it is in the latter.

Q. What! the earth nearer the ſun in winter than it is in ſummer! This is very ſtrange indeed, and contrary to all appearances.

A. It may be fo, and yet it is an undoubted truth; but to underftand it perfectly requires a greater knowledge of aftronomy than you can as yet be fuppofed to have attained. You muft, therefore, for the prefent, take the fact for granted.

Q. Well, fuppofing I take it for granted, I may yet be allowed to afk the reafon why the weather is much colder in winter than it is in fummer?

A. This is owing to a variety of caufes. In the firft place, the nights are longer in winter than the days, and confequently more heat is taken out of the earth in the night time than is infufed into it in the day time: and hence it is, that the weather is always growing colder and colder in winter, as, for a contrary reafon, it is always growing hotter and hotter in fummer.

In the next place, the rays of the fun fall more obliquely upon the earth in winter than they do in fummer, and therefore have a much lefs powerful effect.

It muft be obferved, however, that what we call fummer and winter relates only to our northern latitudes, and to the oppofite fouthern latitudes equally diftant from the equator; for at the equator itfelf, and at the

diſtance of about 23 degrees and a half from it on each ſide, they have, properly ſpeaking, no ſummer or winter at all. They have only inſtead of them, their wet and dry, or their fair and rainy ſeaſons; but during both theſe, the progreſs of vegetation is ſtill carried on, and is never ſtopped, as it frequently is with us during the cold months of winter.

Q. What elſe remarkable have you to mention?

A. It is certainly ſomewhat ſingular, and yet undoubtedly true, that we ſee the ſun for ſome minutes before he actually riſes, and for the ſame ſpace of time after he really ſets.

Q. This is certainly ſtrange; but how can it happen?

A. It happens in this manner. The rays of the ſun, both at his riſing and ſetting, paſs through a large body of thick air, by which they are turned out of a ſtraight line, and bent into a crooked or oblique direction, repreſenting all diſtant objects as being much higher than they are in reality; and the ſun, the moſt diſtant of all viſible objects, at leaſt by day, is ſubject to the ſame law as other bodies. Thus he is viſible, or appears above the horizon, before he really riſes; as he is likewiſe viſible, or appears above the horizon, after he actually

fets; I mean before he either rifes or fets, ftrictly or mathematically fpeaking.

Q. I think I have heard it faid, that there are fome parts of the earth where the days and nights are always equally long.

A. What you have heard is true; for this is the cafe at the equator. The days there are always twelve hours long, and the nights are of the fame length.

Q. Are there not likewife fome parts of the earth where there is only one day and one night during the whole year?

A. There certainly are, and that is at the two poles: for there the fun is vifible, or appears above the horizon, for fix months; and during the other fix months he is invifible, or funk below the horizon.

Q. I fhould like to live at the pole, where the day is of fix months continuance: it muft be a charming fummer: and then, when he began to move towards the other pole, I fhould wifh to follow his courfe, and take up my refidence at the oppofite part of the globe; thus fhifting my quarters, as the phrafe is, according to the feafons, in much the fame manner as our countrymen go to the fouth of France, and to Portugal and Italy, during the cold months of winter.

A. You are pleaſed to be witty, Sir; but perhaps you would not find your habitation at the poles to be ſo very comfortable as you ſeem to imagine: for it is yet a doubt among philoſophers whether the poles do not conſiſt of ſolid ice, or at leaſt are not ſurrounded with iſlands of ice. No man, not even the boldeſt navigator, has ever yet been able to reach, or to approach nearer to it than to within the diſtance of about nine degrees, that is, about 600 miles. This was done ſome years ago by the late Lord Mulgrave, when he was Captain Phipps, who perhaps came nearer to it than any man ever did before.

Q. Are there not ſome parts of the world where the ſun, at certain ſeaſons of the year, is in the zenith of the inhabitants, that is, directly over their heads?

A. Yes; this happens in all places in the torrid zone, or between the tropics of Cancer and Capricorn; that is, for an extent of 47 degrees, or 3,266 miles in breadth; and in all theſe places the ſun is vertical, or directly over the heads of the inhabitants, not only once, but even twice a year, except at the tropics themſelves, where it is vertical only once.

Q. It muſt ſurely be exceſſively hot in thoſe countries: is it not?

A. It is ſo in general, though not ſo much as one would imagine; for when the ſun is vertical, it is commonly their cloudy or rainy ſeaſon, which ſerves to intercept its rays, and to cool the ſurface of the earth.

Q. What is the circumference of the earth? I mean how many miles is it round?

A. About 25,000 miles.

Q. Was it ever ſailed round?

A. Frequently: firſt by Magellan, a Spaniard; afterwards by Sir Francis Drake, our own countryman; and, in latter times, by Commodore Byron, Captains Cook, Furneaux, Carteret, Wallis, and others.

Q. What diſcoveries did theſe circumnavigators make?

A. The two firſt made very few; but the laſt have found that the great South Sea, in certain latitudes, is covered with an infinite number of iſlands, and one of them in particular, called New South Wales, ſo large, that it almoſt deſerves the name of a continent.

Q. I think I have heard of a remarkable circumſtance that occurs according as a ſhip directs her courſe eaſt or weſt in ſailing rouud the world. Is there not ſuch a one?

A. There certainly is, and it is this. If a ſhip ſets out from any port, and ſails round the earth eaſtward to the ſame port again, let her take what time ſhe will to do it in, the people in that ſhip, in reckoning their time, will gain one complete day at their return, or count one day more than thoſe who reſide at the ſame port; becauſe by going contrary to the ſun's diurnal motion, and being forwarder every evening than they were in the morning, their horizon will get ſo much the ſooner above the ſetting ſun than if they had kept for a whole day at any particular place. And thus, by cutting off a part proportionable to their own motion, from the length of every day, they will gain a complete day of that ſort at their return; without gaining one moment of abſolute time more than is elapſed, during their courſe, to the people at the port.

If, on the other hand, they ſail weſtward, they will reckon one day leſs than the people do who reſide at the ſaid port, becauſe, by gradually following the apparent diurnal motion of the ſun, they will keep him each particular day ſo much longer above the horizon as anſwers to that day's courſe; and by that means they cut off a whole day in reckoning at their return, without loſing one moment of abſolute time.

Hence, if two ſhips ſhould ſet out at the ſame time from any port, and ſail round the globe, one eaſtward and the other weſtward, ſo as to meet at the ſame port on any day whatever, they will differ two days in reckoning their time, at their return. If they ſail twice round the earth, they will differ four days; if they ſail thrice, they will differ ſix days; if four times, eight days, &c.

OF THE WINDS.

Q. I ſhould like to have a more particular account of the winds than any I have yet received: will you be pleaſed to give it me?

A. I will endeavour to do ſo.

Q. I ſhall be much obliged to you.

A. You know then, as I formerly told you, that wind is chiefly occaſioned by a rarefaction of the air; for when the air is rarefied, it naturally aſcends into the higher regions; and the circumjacent air, which is thicker and heavier, immediately ruſhes in to ſupply its place, and fill up the vacancy. This motion of the air we call wind, and we give it the name of a breeze, a gale, or ſtorm, according to the quickneſs or velocity of its motion.

Q. All this I perfectly underſtand, and very well remember. But I wiſh you would be a little more particular. Are there not certain winds, called tropical winds, which blow almoſt always from the ſame point of the compaſs?

A. There are; and they are of three kinds. 1.—The *general trade winds*, which extend to nearly thirty degrees of latitude on each ſide of the equator, in the Atlantic, Ethiopic, and Pacific oceans. On the north ſide of the equator they blow from north-eaſt, on the ſouth ſide from ſouth-eaſt, and near the equator from almoſt due eaſt.

2.—The *monſoons*, or ſhifting trade winds, which blow ſix months in one direction, and the other ſix months in an oppoſite direction. Theſe are moſtly in the Indian or Eaſtern ocean, and do not reach above two hundred leagues from the land. Their change is at the vernal and autumnal epuinox, and it is accompanied with terrible ſtorms of thunder, lightning, and rain.

3.—The *land and ſea breezes*, which are periodical winds, and blow from the land from night to about mid-day, and from the ſea from about noon to midnight. Theſe winds do not extend above two or three leagues from the ſhore.

Beyond the latitude of thirty degrees, north and ſouth, the winds, as we daily perceive in Great Britain, are more variable, though it may be obſerved in general, that the tendency of the wind is from a colder region to that which is hotter.

OF THE TIDES.

Q. What have you to obſerve of the tides beſides what you formerly mentioned?

A. It muſt firſt be obſerved, that the ſun, as well as the moon, attracts the earth; he attracts it, however, with much leſs force, on account of his infinitely greater diſtance.

Q. When have we the higheſt tides?

A. At the new and full moon, and the tides then are called ſpring tides; for at theſe times the actions both of the ſun and moon are united, and draw in the ſame ſtraight line, and conſequently the ſea muſt be more elevated. At the conjunction, that is, the new moon, when the ſun and moon are on the ſame ſide of the earth, they both conſpire to raiſe the waters in the zenith, and conſequently in the nadir; and at the oppoſition, or full-moon,

when the earth is between the ſun and moon, while one occaſions high water in the zenith and nadir, the other does the ſame.

Q. When do the loweſt tides happen?

A. The loweſt tides, or, as they are uſually called, the neap tides, happen about the firſt and laſt quarters of the moon; for then the influence of the ſun and moon counteract each other: the ſun raiſes the waters where the moon depreſſes them, and depreſſes where the moon raiſes them; ſo that the tides are only occaſioned by the difference by which the action of the moon, which is neareſt us, prevails over that of the ſun.

Q. Do theſe things happen regularly?

A. They would do ſo, were the whole ſurface of the earth covered with water; but as there is a multitude of iſlands and continents, which interrupt the natural courſe of the water, a variety of appearances are to be met with in different places, which cannot be explained without regarding the ſituation of ſhores, ſtraits, and other objects, which have a ſhare in producing them.

Q. Are there not various currents in the ſea?

A. Yes; there is a current between Florida and the Bahama Iſlands, which always runs from north to ſouth. A current runs con-

ſtantly from the Atlantic, through the Straits of Gibraltar, into the Mediterranean. A current ſets out of the Baltic Sea, through the Sound or ſtrait between Sweden and Denmark, into the Britiſh ocean, ſo that there are no tides in the Baltic.

Q. But if a current conſtantly runs from the Atlantic into the Mediterranean, is it not ſtrange that the waters of the ſea do not increaſe?

A. No: the water extracted from it in vapours is more than ſufficient to counterbalance the influx.

Q. How does this appear?

A. It has been found by calculation, that in a ſummer's day, there may be raiſed, in vapours, from the Mediterranean, 5280 millions of tons of water, yet this ſea receives not from all its nine great rivers above 1827 millions of tons per day, which is but one third of what is exhauſted in vapours; ſo that, where it not for the influx from the Atlantic, the Mediterranean would ſoon be rendered dry.

Q. How high do the tides ever riſe?

A. About ſmall iſlands, and headlands in the middle of the ocean, the tides riſe very little; but in ſome bays, and about the mouths of rivers, they riſe from 12 to 50 feet.

Q. Are the tides always higheſt preciſely at the time of the new and full moons?

A. No; they are generally higheſt about three tides after.

Q. Are the ſame tides, viz. ſpring and neap, of the ſame height in the ſame place all the year round?

A. No; for as I have already ſaid, the earth is ſomewhat nearer the ſun in winter than it is in ſummer; and therefore the greateſt equinoctial tides are obſerved to happen ſome time before the vernal equinox, and a little after the autumnal one.

ELECTRICITY.

Q. Whence comes the word electricity?

A. From a Greek word signifying amber, which was the first substance that was observed to have the property of attracting straws, and other light bodies: for this was the simple origin of a science that is now arrived at very great perfection.

Q. Is not the word electricity commonly taken in a more extended sense?

A. It is commonly understood to mean the electrical matter, or the art of putting that matter in motion, or calling it into motion.

Q. What is the electrical matter?

A. It has long been supposed to be subtle fire that pervades all nature, and produces the most surprising effects.

Q. What are the principal of these effects?

A. Thunder and lightning, earthquakes, and the *Aurora Borealis*, or northern lights, are owing to the same cause.

Q. How does it appear that thunder and lightning are owing to electricity?

A. Dr. Franklin has proved, by a variety of experiments, that the lightening of electricity, and the lightning that flashes from the clouds in a thunder storm, are exactly of the same kind, and operate in the same manner.

Q. I should be glad to hear the particular points in which these two kinds of lightning agree, and produce the same and similar effects?

A. You are right in saying similar; for though they are certainly the same in kind, they are not the same in degree: the works of men can never equal the operations of nature.

Q. In what respects, then, do they agree?

A. I shall inform you almost in the doctor's own words: after observing, that electricians have the art of making a machine, by which they can draw fire from a variety of bodies, and even accumulate it in such quantities, that when it is discharged it will make a report like a pistol, and even kill animals.

Q. I should like to see such a machine.

A. You may see it at the shop of any maker of mathematical instruments, and such are to

be found in every capital town in the kingdom. But to defcribe to you a machine, which you could not make, would not only be dry and uninterefting, but almoft unintelligible. You muft, therefore, at prefent, take the thing for granted.

Q. Very well; proceed, if you pleafe, with the particulars in which thefe two kinds of lightning agree.

A. Here, then, they follow:

1. Flafhes of lightning, fays the doctor, are generally feen crooked, and waving in the air.—The fame,' he adds, is the electric fpark always, when it is drawn from an irregular body at fome diftance.

2. Lightning ftrikes the higheft and moft pointed objects in its way preferable to others, as high hills and trees, towers, fpires, mafts of fhips, points of fpears, &c. In like manner, all pointed conductors* receive or throw off the electric fluid more readily than thofe that are terminated by flat furfaces.

* Conductor is a term ufed by electriaians for denoting any thing that conducts the electric fire from one body to another.

3. Lightning is obſerved to take the readieſt and beſt conductor. So does electricity in the diſcharge of the Leyden phial.*

For this reaſon the doctor ſuppoſes, that it would be ſafer, during a thunder ſtorm, to have one's clothes wet than dry, as the lightning might then, in great meaſure, be tranſmitted to the ground, by the water on the outſide of the body. It is found, he ſays, that a wet rat cannot be killed by the exploſion of the electrical bottle, but that a dry rat may.

4. Lightning burns: ſo does electricity.—Dr. Franklin ſays, that he could kindle with it hard dry roſin, ſpirits unwarmed, and even wood.

5. Lightning ſometimes diſſolves metals: ſo does electricity.

6 Lightning rends ſome bodies: the ſame does electricity. Dr. Franklin obſerves, that the electric ſpark would ſtrike a hole through a quire of paper.

7. Lightning has often been known to ſtrike people blind. And a pigeon, after a violent

* A glaſs that contains an accumulation of electric matter.

ſhock of electricity, by which the doctor intended to have killed it, was obſerved to have been ſtruck blind likewiſe.

8. Lightning deſtroys animal life. Animals have likewiſe been killed by the ſhock of electricity. The largeſt animals, which Dr. Franklin and his friends had been able to kill, were a hen, and a turkey which weighed about ten pounds.

To demonſtrate, in the cleareſt manner poſſible, the ſameneſs of electrical fire with the matter of lightning, Dr. Franklin, aſtoniſhing as it muſt have appeared, contrived actually to bring lightning from the heavens, by means of an electrical kite, which he raiſed when a ſtorm of thunder was perceived to be coming on.

This kite had a pointed wire fixed upon it, by which it drew the lightning from the clouds. The lightning deſcended along the hempen ſtring that held the kite, and was received by a key tied to the extremity of it; that part of the ſtring which the doctor had in hand, being of ſilk,* that the electric fire might ſtop at the key, and not reach his body.

* Some bodies conduct the electric fire, and ſome do not conduct: ſilk is a non-conductor.

He found that the ſtring would conduct electricity even when nearly dry, but that when it was wet, it would conduct it quite freely; ſo that it would ſtream out plentifully from the key, at the approach of a perſon's finger.

At this key he charged phials, and from electric fire thus obtained, he kindled ſpirits, and performed all the common electrical experiments.

Q. Was not this diſcovery, of the ſameneſs of lightning and electricity, applied by Dr. Franklin to a moſt uſeful purpoſe?

A. It certainly was, namely, to the ſecuring buildings from the dreadful effects of lightning in a thunder ſtorm; for as to the thunder itſelf, or the ſound or noiſe we hear, it is perfectly harmleſs; it is the lightning alone that does the miſchief.

Q. How did he effect this?

A. Only by fixing a pointed iron rod higher than any part of the building, and joining to the lower end of it a wire, which communicated with the earth, or rather the neareſt water. This rod the lightning was ſure to ſeize upon in preference to any other part of the building, and deſcended along it and the

wire till it reached the earth, where it was inſtantly diſſipated without doing any harm.

Q. Ought not all public buildings, and eſpecially all magazines, to have ſuch an apparatus for defending them from lightning.

A. They certainly ought, and many, I believe, have.

Q. Does lightning do great miſchief in this cold climate of England?

A. Not frequently; yet ſuch a thing ſometimes happens, as was the caſe with St. Bride's church, in London, the ſteeple of which was damaged by the thunder ſtorm in 1764.

Q. Is not the fire of electricity very different from common fire?

A. It is, and operates in a very different manner. It has been known to melt a ſword in the ſcabbard without injuring the ſcabbard itſelf; and to melt money in a man's pocket without burning his cloaths. In a word, it ſeems to be of ſuch a nature, that it can eaſily penetrate through porous bodies without affecting them, and ſpends all its force upon thoſe that are hard and ſolid.

Q. May not the experiment of drawing lightning from heaven, by means of an electric kite, be attended with danger?

A. It no doubt may, and even actually has. It proved fatal to Abbé Richman, who, in 1753, was killed by a flash of lightning which he drew down from the clouds, in an experiment he was making at Petersburg.

Q. Has not electricity been applied to some medical purposes?

A. It has, and that too, it is said, with so much success, that it may now be considered as part of the science. We believe, however, that those who adminster it are rather looked upon by the rest of the faculty as so many quacks, as indeed the exhibiters of all new medicines are till their authority is firmly established.

Q. May not some electrical experiments be performed without the help of an electrical machine?

A. Yes, such as shew the attractive and repulsive power of bodies, but not such as produce lightning. Here follows one. Cut two bits of cork into the shape and size of a common pea. With a needle draw a thread through each of the corks, so that they may hang at the ends of the threads with a knot below them. Let the other ends of the threads be inserted in the notch of a small piece of wood, about a foot long, an inch

broad, and of the thicknefs of a common match. Lay the piece of wood over the mouths of two wine glaffes, a few inches afunder, fo that the end of it, in which the threads are, may project over the edge of the hither glafs, and the corks may be in contact with one another. Take another wine glafs, and having rubbed it heartily with a piece of flannel, or the fkirt of a woollen coat, hold its mouth to within about an inch of the corks, and you will fee them fuddenly ftart and continue afunder for a confiderable time.

Q. How does it appear that electricity has any fhare in producing earthquakes?

A. This has been already explained in page 26.

Q. You faid, that in the opinion of fome philofophers, the *Auroræ Boreales*, or northern lights, are owing to electricity. Who are the philofophers that entertain this opinion?

A. Signior Beccaria, of Turin, was the firft that advanced it. He thinks that the *Aurora Borealis* may be an electric matter performing its circulation in fuch a ftate of the atmofphere as renders it vifible, on approaching nearer to the earth than ufual.

He was followed in the fame fentiments by Mr. Canton, our countryman, who fays, that

the *Aurora Borealis* may be the flaſhing of electric fire from poſitive towards negative clouds,* at a great diſtance, through the upper part of the atmoſphere, where the reſiſtance is leaſt. He ſuppoſes that the *Aurora Borealis*, which happens at the time that the needle (in the mariner's compaſs) is diſturbed by the heat of the earth, is the electricity of the heated air above; and this, he ſays, will appear chiefly in the northern regions, as the alteration in the heat of the air in thoſe parts will be the greateſt.

This hypotheſis will not ſeem improbable, if it be conſidered that electricity is now known to be the cauſe of thunder and lightning; that it has been extracted from the air at the time of an *Aurora Borealis*; that the inhabitants of the northern countries obſerve the aurora to be remarkably ſtrong when a ſudden heat happens after ſevere cold weather; and that the curious in theſe matters are now acquainted with a ſubſtance that will, without friction, both emit and abſorb the electric fluid, only by the increaſe or diminution of its heat; this is the Tourmalin, a ſingular kind of

* Clouds are ſaid to be poſitive when they have too much electricity, and negative when too little.

ſtone, the properties of which were about this time diſcovered.

Q. Is not electricity ſuppoſed to be the cauſe of many other phenomena beſides thoſe you have mentioned?

A. Signior Beccaria thinks it is the cauſe of *water ſpouts*. To make this the more evident, he firſt deſcribes the circumſtances attending the appearance of theſe ſpouts. They are as follow:—

They generally appear in calm weather. The ſea ſeems to boil, and ſend up a ſmoke under them, riſing into a hill towards the ſpout. At the ſame time, perſons who have been near them have heard a rumbling noiſe. The ſhape of a water ſpout is that of a ſpeaking trumpet, the wider end being in the clouds, and the narrower end towards the ſea.

The ſize is various, even in the ſame ſpout. The colour is ſometimes inclining to white, and ſometimes to black. Their poſition is ſometimes perpendicular to the ſea, ſometimes oblique, and ſometimes the ſpout itſelf is in the form of a curve. Their continuance is very various, ſome diſappearing as ſoon as formed, and ſome continuing a conſiderable time. One that he had heard of continued

a whole hour. But they often vaniſh, and preſently appear again in the ſame place.

Q. Does not Beccaria likewiſe ſuppoſe that whirlwinds and hurricanes are owing to electricity?

A. He does, and adds, that what water ſpouts are at ſea, whirlwinds and hurricanes are by land. They have been known to tear up trees, to throw down buildings, make caverns in the earth; and, in all theſe caſes, to ſcatter earth, ſtones, bricks, timber, &c. to a great diſtance in every direction. Great quantities of water have been left, or raiſed by them, ſo as to make a kind of deluge; and they have always been attended with a prodigious rumbling noiſe.

That theſe phenomena depend upon electricity, cannot, he ſays, but appear very probable, from the nature of ſeveral of them; but the conjecture is made more probable from the following additional circumſtances:

They generally appear in months peculiarly ſubject to thunder ſtorms, and are commonly preceded, accompanied, or followed by lightning, rain, or hail. Whitiſh or yellowiſh flaſhes of light have ſometimes been ſeen moving with prodigious ſwiftneſs about them. And, laſtly, the manner in which they termi-

nate exactly resembles what might be expected from the prolongation of an electrified cloud towards the sea; the water and the cloud mutually attracting one another: for they suddenly contract themselves, and disperse almost at once; the cloud rising, and the water of the sea under it falling to its level.

But the most remarkable circumstance, and the most favourable to the supposition of their depending upon electricity, is, that they have been dispersed by presenting to them sharp-pointed knives or swords. This, at least, is the constant practice of mariners, in many parts of the world where these water spouts abound; and he was assured, he says, by several of them, that this method has often been attended with success.

Q. I think I have heard it said, that the meteor we usually call a falling star is an electrical appearance: is it so?

A. It probably is; and the fact, which Signior Beccaria mentions in confirmation of this opinion, is very curious and remarkable.

As he was one time sitting with a friend in the open air, an hour after sun-set, they saw what is called a falling star directing its course towards them, and apparently growing larger and larger, till it disappeared not far from

them; when it left their faces, hands, and cloaths, with the earth, and all the neighbouring objects, ſuddenly illuminated with a diffuſed and gentle light, attended with no noiſe at all.

While they were ſtarting up, ſtanding, and looking at one another, ſurpriſed at the appearance, a ſervant came running to them out of a neighbouring garden, and aſked them if they had ſeen nothing; for that he had ſeen a light ſhine ſuddenly in the garden, and eſpecially upon the ſtreams which he was throwing to water it?

GALVANISM, OR VOLTAISM.

Q. Pray what is Galvaniſm?

A. A peculiar method of exciting electricity; and it was ſo called from Galvani, an Italian, who firſt diſcovered it. But the moſt important facts have ſince been made known to the world by Volta, another Italian, and

hence it is often called Voltaifm, and will, probably, hereafter always bear this name.

Q. What is the difference between electricity and voltaifm?

A. Electricity is produced by friction, and even by the contact of bodies. But in voltaifm, it is neceffary that the bodies by which it is exhibited fhould have fome chemical agency on each other.

Q. Pray what do you mean by chemical agency?

A. Here is a piece of fal-ammoniac, and alfo a piece of foda; they have, feparately, little or no fmell, but if you fcrape fome powder off from each, and mix the two fubftances, you have a very powerful fcent. In this cafe there is a chemical agency or action between the two bodies.

Q. But how is the fmell produced?

A. The fal-ammoniac confifts of two fubftances, viz. of muriatic acid, and ammonia in a ftate of gas; now the foda attracts to itfelf the muriatic acid, and the ammonia flies off; it is this which you fmell. It probably reminds you of fpirits of hartfhorn.

Q. Is ammonia and hartfhorn the fame thing?

A. They are nearly fo; the former is in a

ſtate of gas, like air, and inviſible; the latter, as you know, is a liquid.

Q. How does this apply to galvaniſm?

A. Here is a piece of metal called zinc, which you may put to your tongue, and you will find it has but little taſte: try a ſhilling or half crown in the ſame way, and that has no taſte: but lay the zinc under the tongue, and the ſilver upon it, and bring the outer edges together: now you have a rather powerful taſte.

Q. How is this explained by chemical action?

A. Theſe metals act very powerfully on each other, and on the ſaliva in the mouth, which fluid they decompoſe, and hence the ſenſe of taſting is excited.

Q. What other common facts have you in explanation of this?

A. Porter taken out of a pewter pot has a peculiar taſte very different from what it has when drunk out of glaſs or earthenware; this peculiar taſte is an effect of the ſame ſort.

Q. Where are the two metals?

A. Your obſervation is juſt; but though there are not two metals, there are two fluids, viz. the porter and the ſaliva on the lips; and the voltaic action will take place between

two fluids and a metal, or between two metals of different kinds and a fluid.

Q. How is this action explained?

A. To take an easy example: Water is a compound of two gases, viz. oxygen gas and hydrogen gas; now the galvanic action decomposes water, and converts it into these two gases, the oxygen gas unites with the metal, and the hydrogen escapes.

Q. Is the metal different after the oxygen is combined with it?

A. Yes; it is then an oxide: thus silver and oxygen is called the oxide of silver; and when united with zinc, iron, &c. they become oxides of zinc or iron.

Q. Are any other substances besides metals and fluids affected by the voltaic fluid?

A. The nerves and muscles of animals are very readily affected.

Q. Does it require a large accumulation of the fluid for this purpose?

A. The nerves of animals are affected by smaller quantities of electricity than any other substances?

Q. How is this done?

A. 1. If a living frog, or a fish, as a flounder, be placed on a piece of zinc, with a slip of tin-foil on its back, and a communi-

cation be made between the zinc and tin-foil, the mufcles are excited.

2. If a perfon, in a dark room, put a flip of tin-foil upon the bulb of one of his eyes, and a piece of filver in his mouth, by caufing thefe to communicate, a flafh of light will be feen.

Q. How is the communication made?

A. By means of conductors: Conductors are divided into perfect and imperfect; the perfect confift of metallic fubftances and charcoal; the imperfect conductors are water and fome other fluids, as the mineral acids. The fimpleft galvanic combination muft confift of three different conductors, not all of one clafs, in order that they may have a chemical action upon one another.

Q. How are the three bodies placed?

A. When two of the three bodies are of the firft clafs; fuppofe zinc and copper: and water or moiftened flannel the other; a piece of zinc is to be laid on the copper, then the moiftened flannel; then three other layers in the fame manner, and thefe layers may be repeated to any number, and the whole is called a pile, and by touching the upper and lower plate at the fame inftant, a fhock will be felt.

Q. Is this like an electric shock?

A. Something similar; and by other kinds of batteries the shock may be made as strong as you please. The spark given out will burn all kinds of inflammable bodies.

Q. Can several persons receive the shock at the same time?

A. Yes, provided they join hands, and have their hands previously moistened with water.

I will now enumerate the leading facts, which you may commit to memory.

1. Voltaism appears to be only another mode of exciting electricity.

2. Voltaic electricity is produced by the chemical action of bodies upon each other.

3. This electricity can be made to set fire to all inflammable bodies, as gun-powder, charcoal, gold and silver leaf, &c.

4. The nerves of animals are most easily affected by it of any known substances.

5. Voltaic electricity is conducted by the same substances as common electricity.

6. When it is carried through an animal, it produces a sensation resembling the electrical shock.

7. There are certain fiſh, as the electrical eel, the torpedo, and the gymnotus, that have the power of giving the electrical ſhock, which is very ſimilar to that given by the voltaic battery.

FINIS

DIRECTIONS TO THE BINDER

For placing the Cuts.

PLATE, Solar System, facing - - -	PAGE 84
Map of the World - - - - - -	9[illegible]
—— of Europe - - - - - - -	10[illegible]

Brodie and Dowding, Printers, Sarum.